

PATHOLOGY AND
TREATMENT OF RINGWORM

GEORGE THIN

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TREATMENT OF RINGWORM.

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PATHOLOGY
AND
TREATMENT OF RINGWORM.

BY
GEORGE THIN, M.D.



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INTRODUCTORY.

THE diseases now known as Ringworm of the Scalp (*Tinea tonsurans*) and Ringworm of the Body (*Tinea circinata*) had been long recognised before it was suspected that they were caused by a fungus.

The honour of discovering the fungus (*Trichophyton tonsurans*) is shared by Gruby, in France, and by a Swede, Malmsten ; the former having announced the discovery in 1844, and the latter in 1845.

It is my present purpose to describe, so far as is known, the nature and peculiarities of this fungus, the changes in the human skin to which it gives rise, and the treatment which experience shows is most likely to be successful in destroying the parasite and curing the diseases which it causes.

G. T.

Sept. 1887.

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PATHOLOGY

AND

TREATMENT OF RINGWORM.

CHAPTER I.

THE FUNGUS.

THE structure of the fungus is that of a tube. The walls of this tube are formed of a delicate sheath, the contents consisting of a protoplasm, which in the process of development becomes transversely divided by septa.

Within the septa rounded spores are formed (so-called *conidia*). In the further course of development, the sheath gives way, the spores are set free, and each spore becomes capable of development into a fresh mycelium or tube.

The tubes may be found solitary or in parallel lines, or bifurcating and giving off branches from the parent stem indefinitely, according as the nature of the soil in which they grow causes compression or favours free extension in several directions. But the process is always essentially the same. A spore, under conditions favourable to its growth, shows first a more marked differentiation between the wall and its contents; the cell-wall then bulges at one point, the protoplasm follows, and the rounded spore has become a pear-shaped body. The projection increases until we have a short tube, at one end of which the rounded remains of the spore can still be detected.

Finally, as the tube lengthens the remains of the spore disappear, septa begin to form, and new spores are formed.

This is the whole cycle of the development of *Trichophyton tonsurans*.

The fungus being a minute object its structure can only be seen by using a microscope, a power of from 250 to 500 diameters being very suitable for the observation.

There is absolutely nothing in the appearance of the spores or mycelium to distinguish them from those of many other microscopic fungi, known and unknown; a fact that has led to errors of observation which have been copied and handed down from one book to another until they have become classic.

We only know that we are dealing with *Trichophyton tonsurans* when we find it associated with the disease that it causes, or when we find that the fungus we are studying fulfils the characteristic conditions of growth in artificial cultivation.

Trichophyton tonsurans grows on the skin of man, the horse, cow, dog, cat, mouse, and rabbit, and it can be communicated by contact from any one of these animals to the other. Its most frequent seat is the hairy scalp of young persons of both sexes under the age of puberty. Probably next in frequency comes the skin of the horse; and after the horse that of the dog and the cow. In man certain conditions peculiar to the individual or climate, or both combined, render the skin favourably predisposed to its development. But there seems little doubt that the most favourable soil for its growth is the scalp of children, the anatomical conditions of which are specially favourable both to the protection and the observation of the fungus.

The perusal of even recent works on Diseases of the Skin would not lead the reader to believe that *Trichophyton tonsurans* is a specific fungus which is only to be found in the skin of certain animals. Indeed authors of the highest authority have expressed a contrary opinion. Hebra and Neumann have stated that the fungus is identical with *Penicillium glaucum*; ¹ whilst Lowe, in 1850, was led to believe by his experiments that *Trichophyton tonsurans* is a spore-formation of *Aspergillus*, and Dr. Atkinson believed that he had shown that the fungus belongs to the *Mucors* and is probably *Mucor Mucedo*.

¹ For an easy method of demonstrating that *Trichophyton tonsurans* is not *Penicillium* see "Addition to a former paper on *Trichophyton tonsurans*," *Proc. Roy. Soc.*, No. 241, 1885.

These errors are reproduced in the most recent works. They are errors due to foul cultivations, the difficulty of securing and maintaining a pure cultivation of the fungus having been until quite recently very great.

The maintenance of purity in cultivations is hardly attainable except by the more exact new methods which have been lately introduced by experts in the study of lower organisms. The beginner in this department of study, probably a dermatologist without special training, who is led to take up the subject by his interest in the disease, is apt to find at the end of his first month's work that he has developed his original stock of *Trichophyton tonsurans* into one or more of the varieties of the common fungi. If he doubts his results sufficiently to continue his work he will probably come to recognise that he has long lost his original stock and has been cultivating the fungi whose spores are omnipresent in the atmosphere in which he works.

If hairs from the head of a perfectly healthy person are cultivated in any ordinary media, unless special precautions are taken and carried out by the skill of the expert, many of the hairs will be found to have their roots enveloped in a thick mesh of fungus, which, microscopically, it is hard, and perhaps impossible, to distinguish from *Trichophyton tonsurans*. A distinction, however, is to be made by crucial cultivations. The *Penicillium*, *Aspergillus*, *Mucor*, &c., which observers have found in their cultivations, did not come from *Trichophyton tonsurans*, but their spores fell into the media of cultivation from the air or were introduced into them by the instruments employed.

A consideration of a well-known fact ought to have prevented the acceptance of the theory that *Trichophyton tonsurans* is one of the common fungi. Let regard be had to the facility with which the fungus develops in the heads of children. In many cases it suffices for a child to wear for a very short time the cap of another child who has ringworm to ensure the transmission of the fungus to the new soil. But the caps of all children, as a matter of fact, contain on their exposed surfaces multitudes of spores of all the common fungi, and ringworm does not result if these caps be worn.

In villages into which the disease has not been introduced or

in which it has become extinct, numbers of children have their hair and their caps constantly exposed to the atmosphere for years without a single case of ringworm resulting. Yet the atmosphere is loaded with spores of common fungi.

Amongst the erroneous ideas that have originated in the attempted cultivations of parasitic fungi by imperfect methods is the suggestion that these fungi can be developed into each other. There is no doubt that this hypothesis is based on errors of observation, and that the question which has been raised as to the identity of *Trichophyton tonsurans* with the fungi of *Favus* and *Tinea versicolor* must be answered in the negative.

Microscopically these three fungi can be distinguished from each other, and they do not behave in the same way under attempted cultivation.

I have never found *Trichophyton tonsurans* transformed by cultivation into either of these fungi, and I have made many unsuccessful attempts to cultivate the fungus of *Tinea versicolor* in media in which *Trichophyton tonsurans* grows freely. I have made a few attempts to cultivate the fungus of *Favus* in similar media and also failed.

Although this book is intended to be chiefly of an expository and practical character, it may be useful and interesting if I make a few remarks regarding the methods of cultivating *Trichophyton tonsurans*.

And first a preliminary remark. Let no enthusiastic worker begin with the study of this or any other fungus. The isolation and cultivation of fungi and micro-organisms is an art which can only be acquired by practice. The experimenter must first satisfy himself that he can render and keep pure, for at least six weeks, milk, beef-juice, urine, and meat-gelatine, and when he has succeeded in doing this he may begin to work. Until he has acquired the requisite skill to keep these media pure his observations will be worthless.

The range of media suitable for the growth of *Trichophyton tonsurans* is not yet defined. I have reason to believe that several workers are in possession of facts, still unpublished, which show that it is wider than I have found it to be in my experience. So far as my own experiments go, I found that it

was possible to grow *Pencillium*, *Aspergillus*, and other fungi on media in which *Trichophyton tonsurans* was sterile.¹

The ringworm fungus grows freely for a time in aqueous humour, vitreous humour, and the meat-gelatine introduced by Koch.

Aqueous Humour Cultivations.—Take a slide which has a cell and purify it by heat. Purify a cover-glass by passing it through a flame. As soon as it has cooled place a drop of freshly extracted aqueous humour on its centre, using pure instruments. Then insert in the drop a freshly extracted ringworm stump, placing it close to the cover-glass. Invert the cover-glass over the cell, and prevent evaporation by passing a fine brush dipped in oil round the border. Place the slide in an incubator kept at a temperature of 96° to 98° Fahr. Within forty-eight hours the spores in the hair will be found to have projected in the form of short mycelia from the edge of the hair. The growth, however, will not advance far on account of the deficiency of fluid and its rapid decomposition by bacteria, which have been introduced with the hair.

Vitreous Humour is a more convenient medium of cultivation than aqueous humour, on account of the facility for obtaining it in quantity; it was with vitreous humour cultivations that the special character of the fungus was first established. The method which I found suitable was the following: Having collected a number of fresh ox eyes, I cut the ball transversely with a sharp knife, and removed the vitreous humour. When I had collected a sufficient quantity, taking care to keep it free from pigment, it was passed through fine muslin, and was rendered pure by being placed for a sufficient time in a pure flask, immersed in boiling water. When purified it was decanted with proper precautions into pure glasses. The details of the methods for securing and maintaining purity are those devised by Lister, and explained in his paper on "Lactic Fermentation" in the twenty-ninth volume of the *Transactions of the Pathological Society of London*.

The precision and exactitude obtainable by Lister's apparatus and methods are perfect, although the introduction of solid media by Koch (in combinations of gelatine) enable us, in most

¹ See "On *Trichophyton tonsurans*," *Proc. Roy. Soc.*, No. 217, 1881.

cases, to dispense with the more difficult task of working with liquids. The necessity in certain cases of cultivating in liquids has not been superseded, and when they are used Lister's methods will, I believe, be found more reliable than any other yet discovered.



FIG. 1.—A hair from a cultivation on the surface of vitreous humour in a test-glass. A mass of germinating and sprouting spores on a portion of the internal root-sheath which was attached to the hair is seen at the side of the hair-shaft. Buds and mycelium are sprouting from the sides of the hair. (In order to reduce the size of the drawing the centre of the hair-shaft has been left out. No attempt has been made to represent the fungus-growth on the upper surface of the hair, as it lies in the preparation. The outlines were too much obscured by the thickness of the hair to enable this to be accurately done with the camera.)

- (a) The appearance of the inner root-sheath of the hair. The spores which were lying on it are in free development.
 (b) The hair-shaft.

Magnified 450 diameters.

In cultivating *Trichophyton* on vitreous humour, the liquid is decanted into a pure glass and the ringworm hair is laid on its surface.

The glass, properly covered to prevent rapid evaporation,

is placed in an incubator. Within forty-eight hours mycelia will be found growing freely from the affected part of the hair. Numerous spores will be found on the slide which has been prepared for microscopical examination, lying near the hair and showing all stages of budding and development into mycelia. Growth continues for several days longer, but finally becomes checked. It is very rare that true septa form in the mycelium which is developed from the spores in vitreous humour. Usually a series of refractive particles which simulate spores are found, but they are much smaller than true spores and do not appear to undergo development. The characteristic appearances seen are illustrated in Fig. 1.

Appearances such as those shown in Fig. 2 suggest that the refractive particles referred to have something to do with an attempt at formation of spores.

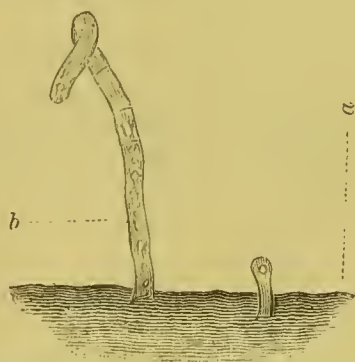


FIG. 2.—MYCELIUM DEVELOPED IN VITREOUS HUMOUR CULTIVATION IN A CELL TWO DAYS IN THE INCUBATOR.

(a) Edge of hair-shaft.

(b) Mycelium.

Magnified 750 diameters.

The mycelia growing free in the liquid occasionally show a characteristic tendency to branch, as is illustrated in Fig. 3.

Only once did I observe an appearance which I considered absolutely distinctive of regular spore-formation. It is shown in Fig. 4.¹

In addition to the growth of *Trichophyton* will be found in these cultivations a growth of bacteria of well-defined forms:

¹ Figs. 1 to 4 are copied from a paper by the author in the *Proceedings of the Royal Society*, No. 217, 1881.

micrococci, rod-shaped bacteria, and sometimes sarcinae. It is evidently through the luxuriant growth of bacteria that the growth of *Trichophyton* becomes checked. As soon as the vitreous humour becomes decomposed, it ceases to be a fit soil for the fungus.

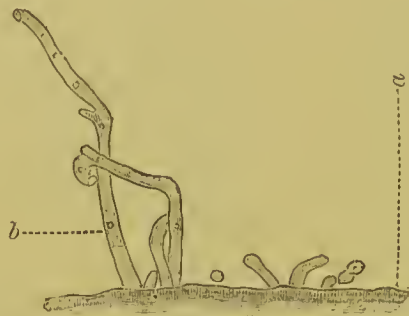


FIG. 3.—A CULTIVATION ON THE SURFACE OF VITREOUS HUMOUR IN A TEST-GLASS.

(a) Edge of hair-shaft.

(b) Mycelium which is beginning to throw off a branch.

Magnified 600 diameters.

It is therefore advisable not to put many hairs in the glass, because the greater the number of hairs the quicker the decomposition of the liquid by bacterial growth. Amongst the



FIG. 4.—TWO DAYS' GROWTH IN A CELL.

(a) Edge of hair-shaft.

(b) Mycelium with true septa.

Magnified 750 diameters.

bacteria that are found developing in such cultivations, it is sometimes observed that special forms are peculiar to certain individuals.

The hairs of some children give rise, for example, to a growth of sarcinae, while those from other children show none. I once

had occasion to observe that in hair cultivations from several children in one family, there was developed a short, thick, and very dark bacterium, almost black in colour. On no other occasion have I observed a similar organism.

I have called special attention to the methods of vitreous-humour cultivation, because there are important problems connected with the life-history of the fungus, and its behaviour on the scalp, which I think are more likely to be solved by this method than by any other.

Meat-Gelatine Cultivations.—The least troublesome and most certain of all the methods of cultivating *Trichophyton*, is the use of the gelatine preparations introduced by Koch.

Tubes of purified meat-gelatine can be bought, and the methods of using them are described in works which are easy of reference.

Several slides, being purified by heat are laid on a table, the surface of which has been made clean by carbolic or bichloride of mercury solutions. A purified glass dish or jar is placed over them to prevent contamination. The tube of neutral meat-gelatine is melted, the cotton plug removed, the edge of the tube passed through the flame of a spirit lamp, and the melted gelatine is emptied on the slides, care being taken that the quantity on each slide is not sufficient to reach the edges. The glass jar, is replaced on the slides until the gelatine has become solid. Short ringworm hairs or stumps being extracted by forceps that have been previously purified by heat, are laid at intervals on the surface of the gelatine into which they are lightly pressed by a purified needle.

A rounded glass dish, on the bottom of which is placed wet blotting-paper, receives a purified glass plate, and on this plate, slightly raised from the blotting-paper by glass rods, the slides are laid. The dish is then covered, the under-surface of the cover having been previously heated with the flame of a spirit-lamp to destroy any spores which were attached to it. The covered dish is then allowed to stand at ordinary room temperature (ordinary meat-gelatines become fluid at body temperature), but a dust-proof cupboard in a warm room is most convenient. The warmer the temperature (so long as the gelatine does not become fluid) the quicker is the growth of the fungus.

The earliest change observed in this as, indeed, in all other cultivations, is the optical separation of the spore into envelope and contents, the spore being somewhat swollen as compared with its size before cultivation was begun. This is illustrated in Fig. 5. It seems to depend on the absorption of fluid, because it is observed in spores attached to hairs when the hairs are soaked in fluid of any kind and when the cultivation remains perfectly sterile.

If one of the slides is examined under a microscope with a low power (fifty to eighty diameters) in two days, if the room has been warm, the spores which were situated on the borders of the hair, will be seen to have grown outwards into the gelatine as short mycelia. This examination can be easily made without the use of a cover-glass, and the slide can be put back in the incubator for further development.

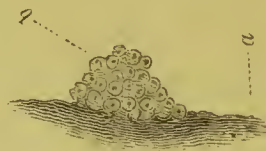


FIG. 5.—FIRST CHANGE OBSERVED IN SPORES AT THE COMMENCEMENT OF CULTIVATION.

(a) Edge of hair-shaft.

(b) A cluster of spores in which the envelope and central point of the spore are differentiated.

The oftener and the longer the slide is exposed to the air, the more numerous will become the colonies of *Penicillium* and other adventitious growths on the gelatine.

Under these conditions the mycelia continue to grow for some days longer. At the end of five days to a week the hair presents a somewhat beautiful appearance. An immense number of mycelial threads have grown out like a brush from the shaft. If the hair selected is a stump from a head that has been treated for ringworm, the free part of the stump remains sterile whilst round the root the growth is abundant. This appearance is illustrated in Fig. 6. Fig. 7 illustrates the appearance of the mycelium grown on gelatine as seen under a high power.

Whilst in these gelatine cultivations the mycelial tubes lengthen and give out branches, the absence of a rapid and true

spore-formation betrays the fact that the fungus is not in its native soil. The rapid subdivision of the protoplasm by septa,



FIG. 6.—A RINGWORM STUMP (FROM A CASE OF TREATED RINGWORM) CULTIVATED ON GELATINE FOR SIX DAYS AT ORDINARY ROOM TEMPERATURE.

(a) Free surface of the hair-shaft.

(b) Abundant growth of mycelia as seen under a low magnifying power.

which is the normal development of the fungus, does not take place in the gelatine cultivations, but as in the vitreous-humour



FIG. 7.—A MYCELIUM AS SEEN UNDER A HIGH POWER ; FROM THE SAME PREPARATION AS IS DRAWN IN FIG. 6.

cultivations there is a more or less successful attempt at this formation. In many cultivations septa or spore formations are

not observed at all, but occasionally an unmistakeable tendency to accumulation of the protoplasm in something like septa is very apparent. This appearance can be sometimes seen more or less distinctly if the preparation is stained by methylene blue. Figs. 8 and 9 from different preparations illustrate this appearance.

Of course the separation of the protoplasm into clumps, even when fairly regular, does not necessarily imply the physiological act of formation of spores, although it is highly suggestive of it. It may, on the other hand, be a simple physical change in the protoplasm produced by its being in a non-natural medium.

These experiments show that *Trichophyton tonsurans* (which,

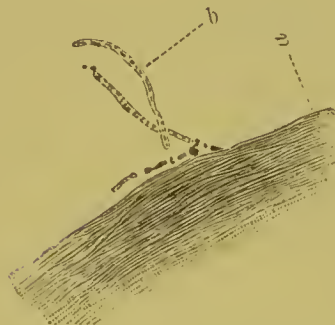


FIG. 8.—A GELATINE PREPARATION STAINED IN METHYLENE BLUE.

(a) Edge of hair-shaft.

(b) Mycelium in which the protoplasm has separated into clumps suggestive of an attempt at spore formation.

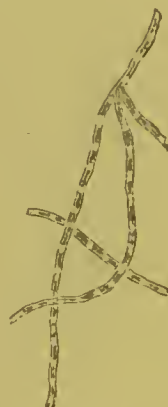


FIG. 9.—MYCELIUM FROM ANOTHER PREPARATION, IN WHICH THE SAME APPEARANCE WAS EVEN MORE STRONGLY MARKED.

as we have seen, is a fungus by itself and totally distinct from the common fungi whose spores infest all the objects by which we are surrounded) can be cultivated artificially in media derived from animal organisms or substances. Speaking metaphorically, it may be described as a carnivorous fungus. It is not only carnivorous in the general sense of the word, but with the daintiness which characterises so many low organisms, it only grows on certain structures or parts of the animal on which it lives.

The home of this fungus is in certain structures of the skin of some of the mammalia. We have no evidence that it lives and propagates in any other soil; and in the affected animals it

is only in certain epidermic structures that it finds its pabulum. So dainty is it, that it is not all epidermic structures in which it will live. Its veritable home is certain parts of the horny layer of the epidermis. There is no evidence that it grows or exists in the mucous layer (*rete mucosum*). In hairs, in the substance of the nails, in the horny layers of the epidermis, in the space between the inner root-sheath and the cuticle of the hair, such are the parts in which in certain conditions it thrives and multiplies, but nowhere else. As Kuchenmeister long ago pointed out, it does not grow in living tissues.

But the fungus does not grow with equal freedom in all epidermic structures. Even on its own soil it is subject to conditions which apply to all fungi—temperature and moisture. To these two latter conditions it is probably correct to add moisture of a certain kind—but here we come to the region of hypothesis.

It is very possible, although on this point we have no evidence whatever, that the moisture which permeates the epidermis of certain parts of the body, and of certain individuals, is specially favourable to the growth of the fungus. The influence of temperature can be directly proven by experiments in an incubator, that of the human body being found specially favourable to growth; the influence of moisture is shown by the favourable soil the fungus finds in the epidermis of the inner surface of the thighs of certain individuals in hot and moist climates. Our knowledge regarding these conditions is still very elementary. If it were more complete we might possibly understand why ringworm is so much more persistent in some cases than in others. This more accurate knowledge, it is to be hoped, is within the reach of experiment.

No parasite can live in or on the human body without causing the formation of substances which are foreign to the healthy organism. The parasite has the power of splitting up the materials on which it lives. Some of these new substances it appropriates, the others are left as foreign elements. These newly-formed substances act as irritants or poisons on the tissues with which they come in contact. Even the vegetable parasites of the skin possess this power in a greater or less degree. First in destructive power is the fungus of *Favus*, then comes *Tricho-*

phyton tonsurans; lastly, and much less injurious than the first two, comes the fungus of *Tinea versicolor*.

The irritation caused by the growth of *Trichophyton* in the epidermic structures leads to the symptoms which are characteristic of ringworm in its various forms. These symptoms are symptoms of inflammation, the special characters of the inflammation depending on the peculiar action exerted on the living tissues, particularly on the blood-vessels, by the new substances produced in the epidermis by the fungus appropriating the elements necessary to its growth. The fungus itself, and its new products, are the combined causes of this inflammation. The nature and degree of the symptoms thus produced depend on the anatomical structure of the part in which the fungus grows, and on the special irritability or vulnerability of the tissues of the patient. A consideration of these various symptoms leads us to the practical part of our task, that which concerns itself with the etiology, pathology, diagnosis, and treatment of ringworm.

CHAPTER II.

ETIOLOGY.

THE etiology of ringworm is concerned with the circumstances that lead to the contact of the spores of *Trichophyton tonsurans* with the surface of the skin; and with the condition of the skin that causes it to be an appropriate soil in which the fungus can take root and grow. First in order of the causes of the disease are the causes that lead to the contact of the spores with the skin. The most frequent and direct cause is that of the simple contact of one person with another, and, in the great majority of cases, of one child with another.

The hairdressers' tools are not unfrequently the conveyers of contagion. Not only does he of necessity cut the hair of children who unknowingly suffer from ringworm, but the parents of the affected children, who are advised to have the

head shaved or closely cut, have no difficulty in getting it done by a barber. That spores may be conveyed from one child to another when towels, brushes, cravats, &c., are used in common, is easily understood.

It frequently happens that ringworm has existed in the head of a child for some time without its presence being known. Other children playing with such a child are readily infected. Children, in play, pass their hands through each other's hair, put on each other's caps, or bring their heads into direct contact. Spores are thus conveyed, directly or indirectly, from one head to another. This is probably the most frequent cause of ringworm being spread.

Ringworm of the body is not unfrequently communicated to adults who attend to children suffering from ringworm of the head. In this case it is usually found on the hands and arms. Direct contact of clothes, particularly with the caps of ringworm children, probably also occasionally communicates the disease. I have heard of a schoolroom in which the children, as they entered, threw their hats and caps into a large receptacle provided for the purpose; and as in such a school it is almost certain that some of the children are affected with ringworm, it is quite conceivable that the disease may be occasionally thus conveyed. The crowding and grouping of children directly favours the spread of this disease, particularly under circumstances in which, as is commonly the case, no care is taken to secure that the children are free from it.

My own experience leads me to believe that ringworm of the head is more common in London than in any other large city; more common even than in Paris, and greatly more common than in Vienna or Berlin, and far more common still in proportion than in country towns and villages. Ringworm in the commoner schools of London has indeed become a great evil, with which it seems hardly possible to cope. No effectual means are taken to exclude affected children, and it is doubtful whether their exclusion, involving a long absence with probably insufficient medical care, will ever be seriously attempted. The very proper exclusion from the higher schools of ringworm children, although often a great hardship in individual cases, certainly tends to check the disease. But there is no such

provision made in the populous schools attended by the children of the working and poorer classes. The consequence is, that there is in our midst an ever-present source of contagion, and the disease increases and multiplies to the great detriment of many children, both poor and rich.

Ringworm is occasionally acquired by contagion from the lower animals. This is probably not very frequently the case, but it undoubtedly occurs. The first authenticated case of the kind was published by Dr. Houlez, of Lorèze, who communicated a paper on the subject to the Medical Society of Toulouse, in 1845. Méguin mentions an instance of fifteen soldiers becoming simultaneously affected with *tinea circinata* of the face and neck, from sleeping on horse blankets which had been used for horses suffering from the disease. Dr. Fleming has communicated to me the details of a case in which a dog, having become affected by lying on the cover of a horse which had the disease, communicated it to his master. I have myself observed ringworm in two sisters who had been fondling a dog which was affected; but who, so far as could be ascertained, had not been subjected to any other source of contagion. This is the source for which it is always well to search when there is no history of direct contact with affected persons.

Possibly the disease may be communicated from laundries, but I know of no proof that it has occurred.

Certainly there are cases that occur from time to time in which it is not possible to discover any source of contagion. I was consulted in the case of a young lady who had *tinea circinata* on the back of the hand, and who lived in a house amongst whose inmates, it is certain, there was no case of this disease. She had not for a long time been in contact with any children; and she had no relations of any kind with persons who did not live in the same house as herself. It was impossible, in her case, to discover any source of contagion.

It has been stated that ringworm spores have been detected in the atmosphere of schools attended by children who had the disease. No weight can be given to this statement, and there is little doubt that the spores referred to were the ordinary spores that are always being deposited from the atmosphere of rooms, probably those of *Penicillium glaucum*.

The difficulty of tracing contagion is not peculiar to cases of ringworm. I have seen a case of scabies in a girl living in a country house, far removed from a town, who associated exclusively with her parents and governess, and when there was no other known case in the neighbourhood. When the active agents in producing a disease are microscopic, we must expect, from time to time, to be foiled in tracing the source of contagion.

The skin of different persons, and different parts of the skin of the same person, vary in their suitability for the growth of the fungus. It does not grow, except in extremely rare cases, in the scalp of adults, and it grows more freely in moist parts of the skin than in parts that are dry. A steamy atmosphere, hydropathic treatment, the moist heat of the tropics, are conditions that favour its development.

The influence of moisture in the development of ringworm is shown in the form of body-ringworm common in tropical countries, the so-called Burmese or Chinese ringworm or Dhobie's itch. The skin of the inner surfaces of the thighs being constantly bathed in moisture, and the epidermis of the parts being naturally thin, the fungus is enabled to root itself in that part. But it may last there for years without any other part of the body becoming affected, although it is inconceivable that in washing and other ways, spores are not carried indifferently to other parts of the surface. It is also certain that adults may in many cases handle children affected with ringworm without themselves becoming attacked by the disease, although it is beyond doubt that their hands, and probably other parts of their persons, may come in contact with spores. But if the skin of some persons is not at all liable to be affected by ringworm, and if some parts of the skin of affected persons seem to be proof against it, we are led to consider whether, in a perfectly healthy condition of the skin, ringworm can develop at all. It has, as every student of the literature of the subject well knows, been stated that sickly, scrofulous, and delicate children are more liable to the disease than others. This is a matter which experience alone can decide. My own experience leads me to believe that, while delicate children are as liable to the disease as others, yet perfectly healthy children with excellent constitutions are equally liable to it. The thin delicate

epidermis of childhood seems to afford a natural soil for the fungus. My conviction is strong that children under the age of puberty, particularly those under the age of eight or nine, are all of them capable of developing ringworm if brought into contact with the fungus. At the same time there is no doubt that the rate at which the disease spreads varies much in different children. In some exceptional cases of young children a large part of the head may become affected with great rapidity; while in others the disease will be found limited to a few places, even if it has lasted some time. It is quite evident that the scalp of some children forms a more suitable nidus for the disease than that of others.

It is also very probable that while the fungus can attack and develop in the beard of some men, causing the disease known as Parasitic Sycosis, in that of most men it is probably incapable of taking root. The great frequency of ringworm of the scalp in London, and the great rarity of parasitic sycosis there, seem to me to show that in most men the hairs of the beard are proof against *Trichophyton tonsurans*.

But although the susceptibility in individuals varies, there is no reason to conclude that it depends on a feeble or sickly state of the skin. The requisite conditions are, there is reason to believe, in no sense pathological. They probably consist in certain anatomical peculiarities of the epidermis which enable the spore to come within reach of the nutritive juices on which it lives, and in the moisture which probably in the first instance favours its attachment, and possibly acts on the cellulose envelope of the spore.

The conditions of development are found in the highest degree in the skin of young animals as well as of children. Calves are more liable to be affected than cows, and young horses than old ones. Young horses bought in France for the cavalry are, I understand, frequently found affected, particularly those which come from certain districts. It would seem that as there are cities in which ringworm is unusually prevalent amongst children, so there are districts in which it is unusually prevalent amongst young horses. In both cases the unusual frequency is doubtless due to facilities for infection. There is no more reason to believe that a special delicacy exists amongst children

who have the disease, than amongst the young horses or calves amongst which it prevails sometimes almost epidemically.

The common idea that ringworm is associated with want of personal cleanliness is a mistaken one. Dirt affords no pabulum for the growth of *Trichophyton*, and as a matter of fact many cases which I see come from families in which the strictest cleanliness and care are practised. Whether the frequent scrubbing of the head of a closely cropped boy with soap and water would prevent the fixing of the spores in the soil may be a moot question. But the ordinary washing of the head in boys and girls, with hair of the ordinary length, seems to exercise neither a curative nor a preventive action.

As regards the proportion amongst the sexes, it has been stated that the disease is more frequent amongst boys than girls. Considering the habits of boys this is likely to be the case. But apart from schools, amongst the easy classes, I find the disease, so far as my own experience goes, sufficiently frequent in girls to show that sex has no influence on the soil.

Rank in life has no influence on the frequency of the disease, except that amongst the very poor indifference is shown regarding precautionary measures.

PATHOLOGY.

The pathology of ringworm is that of a specific inflammation; its special characters depending on the effects produced on the blood-vessels of the cutis by the growth of *Trichophyton* in the horny layers of the epidermis and root-sheaths of the hairs.

The various chronic inflammatory affections of the skin owe their peculiar manifestations to the fact that the cause of each of them exercises its injurious influence on the vascular structures in a more or less uniform and specific way. They have all of them certain features in common, and each of them special features which are characteristic. The features which ringworm has in common with other chronic inflammatory affections are alterations of colour produced by congestion, alterations in sensation produced by the influence of effusion on the nerves (and possibly the direct influence on the nerves of

foreign substances produced by the fungus), alterations in size caused by dilated vessels, and the usual deposits which accompany inflammatory congestion. Of the four classic symptoms of inflammation we have thus the *rubor*, *dolor*, and *tumor* more or less clearly represented.

In common also with the other chronic inflammatory skin-affections, we have certain products of inflammation. There is a morbid desquamation of the epidermis; either simple desquamation in the form of dry scales, or the scales are agglutinated by serous or purulent discharge, and crusts and scabs are formed.

Of the special features of the inflammation caused by *Trichophyton* are to be adduced the peculiarities of its localisation, which is non-symmetrical, and the fact that it affects by preference certain parts of the body. The eruption is as a rule distinctly margined, and remains superficial except in very rare instances, leading to nothing approaching to permanent destruction even of the most superficial elements of the skin. As a rule, even after it has lasted a long time, it leaves no permanent trace. In brief, the poison by which this inflammation is caused is sufficiently powerful to lead to effusion from the blood-vessels with its usual results, but not to cause permanent destruction of the mucous layer of the epidermis or connective tissues of the cutis.

The histological changes which accompany this inflammation will be fully dealt with in treating of ringworm of the scalp.

Although the growth of *Trichophyton* always runs through the same stages on whatever part of the body it has taken root, and although the pathological changes to which it gives rise are always essentially the same in their nature, yet the clinical appearances which it causes, and the management of the disease, vary according to the region which is infected. It is thus we have the several varieties of ringworm known as ringworm of the head, of the body, of the nails, of the beard, and tropical ringworm, chiefly affecting the inguinal region. It is necessary, therefore, to treat of ringworm of the several regions separately; and as first in order of importance I shall begin with ringworm of the scalp.

CHAPTER III.

RINGWORM OF THE SCALP.

RINGWORM of the scalp is so rare in adults that it may be correctly stated to be exclusively a disease of children. Lailier and Hardy have stated that they have never seen a case in adults. It does, however, occur. I have myself seen two cases, one of them being that of a woman, who had a patch about the size of a shilling in the centre of the head, half-way between the forehead and the vertex. She contracted the disease evidently from her children, who suffered from it. But there is no doubt of its very great rarity in adults. This is a fact which it is important to bear in mind. Some years ago a lady came from a distance to consult me about an imagined ringworm of the head. For six months extraordinary precautions had been taken in the household to prevent her giving ringworm to her children, precautions that led to the very great inconvenience, if not distress, of all the members of her family. What she was really suffering from was a circumscribed patch of eczema, originally produced by an irritating hair-wash ; and the disease yielded in a few weeks to appropriate remedies.

Method of examining the head.

In examining the head of a child who is suspected to have ringworm, two things are requisite : good light and a lens. The shorter the hair the easier the examination. In the case of a boy it is convenient to pass the hand close to the scalp and move it slowly against the hair in the direction contrary to that in which it lies. By this means it is possible to bring into clear view successively every part of the scalp. In the case of a girl with long hair this somewhat rapid method is not practicable, and it is necessary to use both hands and open out the hair in successive gaps, the procedure requiring considerable time and patience.

As regards the choice of a lens, any ordinary hand-lens, or one similar to that used by watchmakers, does very well. The magnifying power desirable is from two to three diameters. A person with acute vision may dispense with a lens, but it is certainly an advantage. The patient should be placed in such a position that a good light will fall directly upon the part examined.

Progress.

An attack of ringworm of the head is rarely observed from the beginning, some days at least having elapsed before the attention of parents or nurses is called to the appearances which lead to its being suspected.

Sometimes the attention is excited by the head being itchy. The child is observed to scratch, and when it is examined, part of the skin is found to differ in appearance from the rest. This itching, which is probably always present, may be so slight as not to attract attention ; and the first suspicion of something being wrong is due to the nurse or the hair-cutter observing that parts of the head are bald or scurfy.

When the child is brought for examination, it is found that one or more parts of the scalp have undergone certain changes which affect both the surface of the skin and the hairs.

Most usually, if the disease has been detected early, one or more patches, varying in size from a split-pea to a shilling, rather discoloured and more or less covered with scurf are found. They are of a faint brownish colour or of a brownish red, or the colour may be only very slightly changed.

They are, as a rule, slightly raised above the level of the surrounding skin, and have a somewhat dirty scaly appearance. Sometimes, when very little change in colour is to be observed the patch is conspicuous chiefly by being scaly. These appearances are due to congestion of the skin caused by the parasite.

The most constant symptom is desquamation or scaling. The patch is usually circumscribed, and a scaly circumscribed patch on the head of a child must always be viewed with grave suspicion. Certain appearances, due to changes in the hairs convert the suspicion into a certainty, and the first thing we do

when a child with such a patch or patches is brought before us, is to examine carefully the condition of the hairs. To understand how the various appearances of the hairs are produced, it is necessary to premise certain facts regarding the relation of the fungus to the hair-shaft. The fungus enters the hair-shaft near the hair-root well under the surface of the skin, and grows

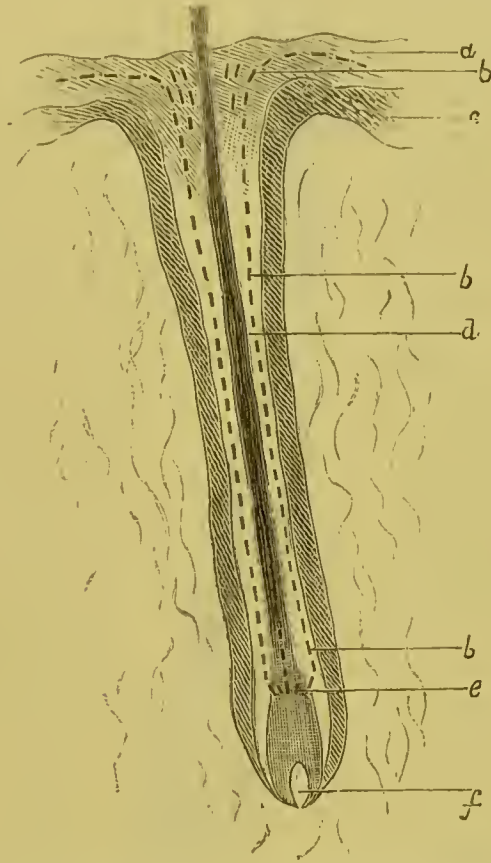


FIG. 10.—SCHEME ILLUSTRATING THE AUTHOR'S VIEWS REGARDING THE INVASION OF THE HAIR-SHAFT BY TRICHOPHYTON.

(a) Horny layer of epidermis ; (b) line of growth of the fungus ; (c) rete mucosum ; (d) hair-shaft ; (e) the point where the fungus enters the hair-shaft ; (f) the hair papilla.

upward into the shaft, and at the same time with great luxuriance between the sheaths of the hair and the shaft.

The consequence of the growth of the fungus in the hair follicle is the production of epidermic *débris* around the hair-shaft, which again leads to a projection of the epidermis upwards around the hair. The hair is seen to be surrounded, at its exit

from the scalp, with a dull grey lustreless sheath. The projecting cone out of which it seems to grow causes an appearance of shagreen or goose-skin. This is the first distinctive sign of the hair being affected with *Trichophyton*, and of the disease being ringworm.

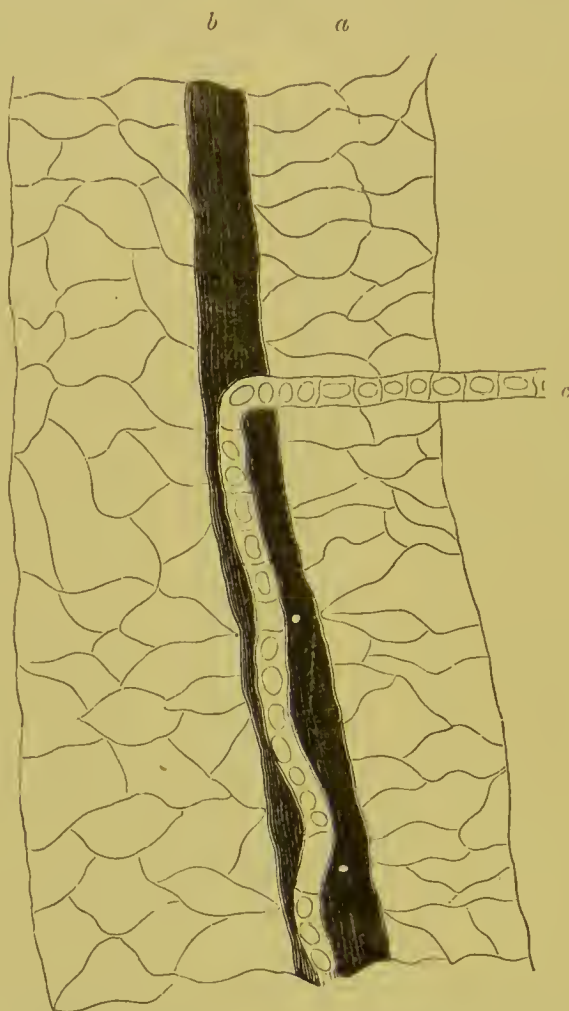


FIG. 11.—A HAIR TREATED WITH STRONG POTASH SOLUTION, BY WHICH IT HAS BEEN BURST.

A solitary mycelium is seen occupying the centre of the hair. By an accident of the preparation part of the mycelium had fallen out of the cavity in the hair and floated in the solution.

(a) The hair ; (b) central cavity in the hair exposed by the potash solution ; (c) mycelium containing spores.

But the growth of the fungus inside the shaft of the hair leads to further and even more distinctive appearances. The closely cemented epithelial cells, out of which the hair is built up,

are dissociated by the masses of growing fungus. The hair, consequently, becomes thicker, fatter, and loses its elasticity. When bent under the finger it does not spring back again into its normal position, thus contrasting in a very marked manner with the other healthy hairs by which it is surrounded.

The affected hairs become bent, twisted, and no longer lie in a parallel direction to that of the healthy hairs of the part of the head. They have been compared appropriately to the stalks of corn beaten down by winds and rain; the stem being broken they no longer regain their former position.

As the fungus grows the hair breaks off entirely, the outer part disappears and is carried away by the comb or brush to other parts of the head, where it deposits some of the spores by which it is loaded, and new foci of the disease are started. The hair does not break off quite on a level with the skin, a stump usually of about $\frac{1}{16}$ to $\frac{1}{8}$ of an inch being left.

The same physical qualities which characterised the hair before it broke are retained by the stump. After all the hairs in and around the patch are closely cut, the stumps of the diseased hairs are found to differ from other short hairs which may be of the same length. They point in various directions, are thick and distorted, and have a lustreless appearance. These stumps form the most characteristic sign of the disease, and the relations of the stump to the uninfected hairs give rise to varieties of ringworm which have been divided somewhat arbitrarily into classes, but which pass indefinitely into each other.

A patch of ringworm may present a well-marginated appearance; all the hairs within the margin having broken and nothing being left but short stumps growing out of minute, slightly elevated cones of epidermis. If left to itself the size of this patch gradually increases. This form is the typical *Tinea tonsurans*; and, except in size and position (sometimes even in these respects), simulates with great closeness the priest's tonsure. The scaly, bald patch, the surface of which is studded with irregular stumps of hairs, presents a distinctive appearance which is hardly mistakable by those who have seen it once. It is well recognised by women of the poorer classes in our large cities, certainly in London.

But the tonsure may not be clean. It is certain that of the hairs of the scalp of the same individual all are not equally readily affected by *Trichophyton tonsurans*. Consequently we have areas containing a certain proportion of stumps, and a certain number of long, unaffected hairs. We have thus patches in which the hair is thin, with characteristic stumps distributed in smaller or greater numbers between the hairs. But even in this case the hairs which at first withstood the disease in most cases gradually succumb. The number of unaffected hairs becomes steadily fewer, and the number of stumps larger, until, eventually, we have the tonsure complete.

The distribution of the fungus amongst the hairs may follow a still more irregular course. In addition to one or several more or less complete tonsures we may have a number of isolated stumps scattered amongst the healthy hairs; only observed by being carefully looked for, and very apt to escape the attention of the patient's friends. It is never safe to accept the statement of parents and nurses regarding the extent of the disease. Their attention is confined, as a rule, to the one or more defined patches; and they are in complete ignorance of the existence of discrete, isolated, diseased stumps.

It is in this form of ringworm, characterised by solitary stumps, that the diagnosis presents difficulty and requires a trained eye. Boys affected with it are sent back again and again by the medical officers of schools after their parents, and sometimes their medical attendants have considered the disease cured. In this form again the characteristic sign is the stump.

Turning our attention from the hairs back to the scalp, we find again considerable differences in its behaviour, and these differences have been and may be taken as a basis for establishing an indefinite number of varieties of the disease.

I have already stated that the characteristic reddish-brown colour of the patches may be scarcely perceptible or even absent. The colour of the ringworm-patch may be a bluish-grey, this effect being produced by the accumulation of epidermic *débris*, or it may not differ at all from the colour of the surrounding skin. No visible sign of congestion may be present. Again, as regards scaliness and desquamation, the signs may be

reduced to a minimum: the epidermic scales may be produced so slightly in excess as not to strike the eye. But this sign is never entirely absent around the stumps where partially detached epidermic scales may usually be seen.

The changes of colour produced by lesions of a more pronounced character than desquamation, by the formation, namely, of papules or pustules, need not be separately described.

So far we have limited ourselves to the appearances produced by desquamation, the most common accompaniment of disease of the hairs. In other cases the symptoms are of a more pronounced type. The inflammation of the hair-follicle produced by the parasite may be so acute, that an inflammatory papule is formed around the base of each affected hair. This papule, which is red and projecting, may not advance to a further stage, although usually it is only transitional to that of a vesicle and pustule.

A minute pustule may be found around the base of each hair. In some rare cases the entrance of *Trichophyton* into a hair-follicle leads at once to suppuration, one or more affected hairs are cast off with the pus, the hair-follicle is destroyed, and a small bald patch remains. The disease is cured.

There are other cases in which the lesions can hardly be termed either papule, vesicle, or pustule. We may find a series of raised inflammatory patches covered with scabs, which, when they are removed, lay bare an oozing surface. These patches are scattered discretely over the head, the lesion somewhat resembling that of a boil. But the appearance is not exactly that of a boil. The inflamed area is irregular, is never quite circular, is usually flattened at the top, and scabs more than a boil does.

This form is likely to be confounded with simple eczema, more particularly as there are usually not many diseased hairs. It is apt to be chronic, as the inflammation is not sufficiently acute to lead to the destruction of the hair and a spontaneous cure.

It is evident that an almost unlimited variety of clinical pictures may be drawn of the appearances produced by these varying conditions of the affected skin and the diseased hairs; but in practice the various types which might be described from

the extreme cases are practically found so to run into each other that it is very doubtful whether it is useful to make distinctions which must always be more or less arbitrary.

Nor is there any well-defined limits as regards time. A ringworm which has lasted a fortnight, and which is spreading rapidly, might well be termed acute, and a ringworm which has lasted two years and is not spreading may, with perfect accuracy be termed chronic. But that after all may not express more than that the one case has lasted a short time, and the other a long time. A ringworm that has lasted three months is often indistinguishable in appearance from one that has lasted three years. It is quite permissible to speak of chronic and acute ringworm; but as the symptoms and pathological conditions are essentially the same in both cases, for practical purposes chronic and acute ringworm need not be placed in separate categories.

Special attention must, however, be directed to the variety of ringworm in which, from the resistance on the part of many of the hairs to the development of the fungus, we have, instead of well-defined patches, numbers of isolated stumps scattered over the head. Very often this condition is associated with one more or less well-defined patch on one part of the head, often on the vertex. As the source of infection in many such cases has been long in operation, and as these isolated hairs have not become the centre of new tonsures, we are bound to assume that for a time, at least, a large proportion of hairs in the head of the individual are not susceptible to infection. What this condition of non-susceptibility is can only be matter of conjecture.

We know that the hairs of the scalp of the adult are not susceptible of ringworm, and it is possible, even probable, that in the cases we are describing a great majority of the hairs have undergone the change, whatever it may be, which enables the hairs after puberty to withstand *Trichophyton*. These cases are in many senses important. They are exceedingly obstinate as regards treatment; possibly the very condition which enables some of the hairs to resist the fungus, renders treatment more futile in the hairs which have become affected. They are further important because they are apt to be overlooked, and so long as they exist the patient is not safe against fresh and further

extension of the disease, and he is a perennial source of infection to other children. I have known boys in which this form existed go on a long time without any extension whatever of the disease, a few isolated obstinate hairs remaining to defy treatment unless they were destroyed altogether.

When there is reason to believe in the existence of this form of scattered or isolated ringworm, the patient's hair should be closely cut, being kept not longer than from one-fourth to one-third of an inch, and the stumps carefully sought for in a good light by passing the forefinger of the left hand slowly against the hair, whilst the scalp is carefully examined with the assistance of a lens, which is held in the right hand. When the stump is detected its position should be marked with an anilin pencil, a drop of ink, or a minute drop of solution of nitrate of silver, so as to mark its position : otherwise it may be impossible to find it again. The examination of such a head requires much time and patience ; and parents and nurses of sufficient intelligence and goodwill for this purpose are not the rule. It will be observed that in this form also the only criterion is the existence of the stump. No broken hair, no certainty of ringworm.

Occasionally the detection of the stump is rendered unusually difficult by the fact of its having broken at the level of the follicle. In this case instead of a projecting stump, a minute black plug takes the place of the hair. Such a black plug is in itself very suspicious, and should be watched. As the hair does not cease to grow, in a few days the black point will have developed into a minute stump.

The appearances caused by ringworm of the head are, as a rule, the more striking the darker the hair of the individual. When the hair is fine and fair the general appearance catches the eye less readily, and the individual stumps are much more difficult to observe.

Although a patch of ringworm is usually more or less circular it is not always so ; it may be elongated or oval, or, while retaining these forms as a whole, the borders may be more or less irregular. The latter condition is present in all degrees in different cases until we come to patches which are not circumscribed at all, the complete, or almost complete, baldness in the

centre of the patch becoming less and less marked as we pass from the centre.

The coalescence of two or more patches sometimes leads to a gyrate form.

The rapidity with which the disease progresses varies very greatly. In some children it runs a rapid course, large bald patches being formed within a few weeks. In very young children the progress is even quicker. In a child between two and three years old with fair hair I have observed the disease sweep over the entire scalp with great rapidity. But these cases are exceptional, usually weeks elapse before the patches acquire much size. Accurate data regarding the time required, in an average number of cases, for the disease to spread over a large part of the head are not easily obtained, because treatment, however ineffectual it may often be in quickly curing the disease, is at least to be credited with the speedy arrest of its extension.

The differences in the rapidity with which the head is invaded in different children are not caused by any varying virulence of the fungus, but depend exclusively on the fact that the head of one child forms a more favourable soil than the head of another, and it is almost certainly the case that one part of the head of the same child favours development more than another part.

Differential Diagnosis.

Although with care the diagnosis of ringworm of the scalp is always, or nearly always, to be made without the use of the microscope, yet there are certain diseases from which there may be some difficulty in distinguishing it. The superficial inflammation of the scalp caused by *Tricophyton* may be considered an artificial eczema, and the question may arise when the patient is brought for examination as to whether we have to deal with ringworm or with simple eczema. As a rule the diagnosis is not difficult, but there are cases in which we are glad to confirm our opinion by microscopical examination of the hairs. Simple eczema of the head is, however, attended with much greater itching than is the case with ringworm and in

young children is usually spread over a large surface and not limited to defined patches, and notwithstanding that a considerable portion of the head may be covered with crusts and exude serum abundantly, the broken hairs distinctive of ringworm are not found. It has been stated as a diagnostic sign that whilst the hairs in ringworm come out easily they are firm in eczema. This is by no means always the case. In any inflammation of the scalp which penetrates sufficiently deeply the hairs may become somewhat loose, and I have in cases of *eczema capitis* extracted hairs from an infiltrated and oozing surface which came out with very little traction.

There are cases which present unusual difficulty. I have under my care at the present time a boy who had extensive ringworm of the scalp which yielded to treatment, with the exception of one small patch about the size of a threepenny piece on the vertex. This patch contains a few obstinate stumps which have been rebellious to all ordinary remedies. One day the boy was brought to me presenting a great number of isolated patches over his head varying in size from a split pea to a shilling, but the patches were not round, and had no uniform shape. They were covered with thick crusts, and when the crusts were removed the base on which they rested was found to be swollen, red, and oozing a clear serum. It was impossible to shut out the suggestion that infection had been carried from the old obstinate patch to other parts of the head, and that we had to deal with an outbreak of acute pustular ringworm. But there were no broken hairs and no stumps, although the hairs came out easily. There were a few pustules on the face, and within a few days his face and ears presented the appearance of an ordinary impetiginous eczema. The microscope showed that the patches were not of the nature of ringworm, and the result of treatment showed that we had to deal with a case of simple eczema.

Another form of artificial eczema is liable to be confounded with ringworm of the head, namely, that which is caused by pediculi. *Pediculosis capitis* occurs more especially on the occipital region. The symptoms are so far acute that an oozing crusted eczema occurs in a great many detached points. The inflamed patches are found most plentiful towards the nape,

on which there are generally signs of scratching. The appearance is characteristic enough to be unmistakable by those who are familiar with it, and the diagnosis need hardly depend on detecting pediculi, as in a susceptible child one or two are enough to excite an extensive eruption. The patches are small and bear the marks of scratching, and the hair is matted and moist. There is, of course, an absence of stumps, and above all the disease is rapidly cured by appropriate treatment with any of the well-known applications which destroy pediculi.

Pityriasis of the head can hardly be mistaken for ringworm. It is not an affection to which children are liable, occurring most frequently in young adults. The surface of the scalp is slightly reddened, and there is an abundant formation of fine branny scales which are found mixed loosely with the hair. Although if the disease persists it is apt to lead to premature baldness, it leads to no breaking of the hairs and no stumps are found.

Seborrhœa capitis might possibly be confounded with ringworm. It is an affection quite distinct from *pityriasis capitis*, being caused by an excessive secretion of sebum. The hairs are matted together or glued to the scalp. The scales and crusts thus formed are usually far in excess of those known in ringworm. They adhere to the skin, which is however not the seat of any acute inflammation, and usually they form a large coherent crust which extends in a sheet over a considerable part of the head. Although this affection also leads to baldness when long persistent, it does so by a gradual obliteration of the hair-follicles and not by the destruction of individual hairs. If the greasy masses are first softened with oil and then washed with soap and water, the absence of ringworm hairs and stumps will be apparent.

Psoriasis capitis might easily be mistaken for ringworm. Psoriasis occurs on the scalp in the form of small or large, usually small, patches, circumscribed and chronic. The scales on the patch are thicker and more coherent than is usually the case in ringworm, and are not glued together like scales in seborrhœa. Usually there is a history or the actual presence of psoriasis on other parts of the body, more particularly on

its common seats. Its presence on these positions facilitates the diagnosis. The hairs on the scalp will be found to be growing unbroken in the patch.

The disease, however, with which ringworm of the scalp is most apt to be, and is most frequently, confounded, is *Alopecia areata*. As a rule the diagnosis between these affections is easy. Sometimes it is difficult, but I believe that without having recourse to microscopical examination, an accurate diagnosis is always possible. The most striking difference between a patch of ringworm and a patch of alopecia areata is the absence of scales and stumps in the latter. The bald patch of alopecia areata is entirely hairless, the skin being white and smooth, and often appropriately likened to the surface of a billiard-ball. But the difficulty has arisen because it has not been recognised that these characteristic conditions are not absolute. In a great number of cases of alopecia areata very fine short stumps are found on the border of the patch; and in some cases, if carefully looked for, and if the part has not been recently washed, very delicate scales may be detected. It does not require much practice to detect the fine stumps; the scales usually escape observation. But these stumps ought not to be confounded with those of ringworm. They are all broken off on a level with the skin, so much so that it is difficult with fine forceps to get sufficient hold to extract them. They do not present the irregular and unsymmetrical appearance of the stumps of ringworm, which, even when some of them are very short, will always in part be found to project sufficiently to show that the hair is bent and twisted. Familiarity with the two diseases is sufficient to prevent the stumps of the one being confounded with those of the other. But even without this familiarity the diagnosis is fortunately made easy by the microscope, the stump of ringworm being full of spores of *Trichophyton*, that of alopecia containing none.

On the other hand, a patch of ringworm may, very rarely, simulate alopecia areata. If the inflammation caused by *Trichophyton* leads to suppuration and the destruction of the follicle, we may have the patch left white and bald; but if the disease is active, the characteristic signs of ringworm will be found on the margin of the patch.

Cases are occasionally described of alopecia and ringworm existing on the head of the same child at the same time. There is no reason why the two diseases should not co-exist. Where ringworm is very common, it would be extraordinary if, from time to time, a ringworm child did not, as well as any other child, contract alopecia areata. But, without throwing any doubt on the fact of their occasional co-existence, I am satisfied from observation of alleged cases that some of them at least are cases of ringworm in which baldness caused by *Trichophyton* has been mistaken for alopecia. There is absolutely no connexion between the two diseases.

Favus can hardly be mistaken for ringworm. It should certainly not be mistaken by any one who had seen a case or who had even seen a good picture of one. And any one at all familiar with ringworm would at once, in a case of favus, recognise that he was dealing with something different. The so-called cups of favus are perfectly characteristic. The disease is a comparatively rare one, and its fungus can be distinguished by the microscope.

To resume, the criterion on which we must always fall back in distinguishing ringworm of the scalp from the other diseases we have mentioned is the existence of broken hairs or stumps. In no other of these diseases, except favus and alopecia areata, do the hairs break. With favus a mistake is hardly possible and would be inexcusable. With alopecia areata the appearance of the stumps is characteristic, and where the clinical experience of the observer is not sufficient to establish a diagnosis, the microscope will decide the question.

Although the naked-eye appearances are thus sufficient to establish the diagnosis, we have, fortunately, a means of making the diagnosis certain by examining for the presence of *Trichophyton* in the hairs. The methods of examination are very simple, and very little familiarity with the use of the microscope is required to enable any one who chooses to become more or less expert.

Microscopical examination of the hairs.

Simple as the examination of a hair for ringworm-spores is, it requires an elementary acquaintance with the use of the microscope and a certain familiarity with the appearance of *Trichophyton*. No one would like to take the responsibility of pronouncing that a hair contained the fungus who had never seen the fungus before. The necessary familiarity should be acquired by every practitioner, and fortunately this is not difficult to accomplish. Stumps should be extracted from a recognised patch of ringworm, and one or more examined.

The usual and best mode of examination is to place the stump in a drop of *Liquor potassæ*, or of an aqueous solution of potash, and wait for a short time before examining. The effect of the potash is to dissolve out fatty matters, and to dissociate the epithelial cells of the hair and thus to bring the fungus clearly into view. When time is an object it is well to use a strong solution of potash. For this reason I generally use a 10 or 20 per cent. solution, and for ordinary purposes I find this is a convenient strength. Where it is for some reason desirable to preserve the hair as a preparation, a weak solution, say 5 per cent., is best; where it is desirable (for example, in a stump loaded with fatty matters) to split the hair to pieces and lay bare the fungus as rapidly and thoroughly as possible, 20 per cent. should be used. But as a rule ordinary *Liquor potassæ* acts very well.

In some cases the hair is so charged with oil-globules that it is impossible, even after the widest experience, to tell whether we are looking at minute droplets of oil or at spores. In such cases it is necessary to dissolve the oil, and ether, chloroform, and alcohol are recommended for the purpose. But even in such cases a strong solution of potash is sufficient if we can afford to wait. If a drop of 20 per cent. solution is used we shall find in half an hour that the oil-globules have disappeared, and that the duller, less-refractive spores have come into view.

The spores of *Trichophyton* as observed in a hair are not always equally round, when they are closely packed in masses. Their naturally round shape is somewhat modified by mutual

compression, and they may sometimes be more correctly described as rounded with a tendency to an oblong shape. They are best recognised by their fairly uniform size, which is considerably smaller than that of a red blood-corpuscle, and by the manner in which they are closely packed in the hair.

Although there are mycelia in the hair-shaft, these are not usually seen in ordinary examinations, but after a strong solution of potash is allowed to act for some time, they are brought into view. Indeed, whenever we find masses of



FIG. 12.—APPEARANCE OF A HAIR INFECTED WITH SPORES OF TRICHOPHYTON. Examined in solution of potash with a magnifying power of about 300 diameters.

spores we know that there are, or have been, mycelia, for it is in the mycelium that the spore is produced.

However, what is usually seen in the ringworm hair or stump is a mass of spores in which a tendency to linear arrangement may be observed. This is not the appearance seen if we chance to examine a hair which has just been attacked by the fungus. In such a hair we often find the hair-shaft intact and entirely free from spores, but in the root-sheath which is extracted with the hair we find mycelium ramifying luxuriantly. In such a hair

the naked-eye signs of ringworm have not been developed, the hair-shaft being sound and unbroken.

In dark-haired children (as in black horses), when the hairs have been long affected by *Trichophyton* we sometimes find on splitting the hairs with strong solution of potash that the mycelium is loaded with pigment, and in the horse particularly I have found free spores the walls of which were black with pigment.

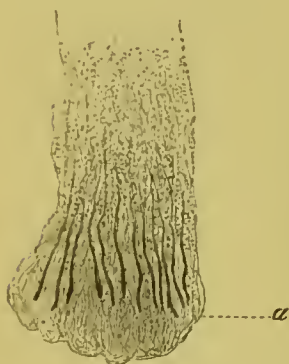


FIG. 13.—A HAIR EXTRACTED FROM THE SCALP OF A DARK-HAIRED CHILD.

The mycelia (dark with pigment) are seen to be situated in the deepest part of the hair, extending into the bulb.

(a) The bulb of the hair.



FIG. 14.—FIVE OF THE MYCELIA SHOWN IN FIG. 13. HIGHLY MAGNIFIED.

Septa are seen dividing the protoplasm of the mycelium, the protoplasm containing pigment which has penetrated the mycelial sheath. The pigment is in the protoplasm and not in the sheath, and is more plentiful in some of the divisions than in others, the septa apparently forming obstacles to its easy diffusion.

As an example of this infection or absorption of pigment by mycelium of *Trichophyton*, I give an engraving of the appearance found in a ringworm-hair from a dark-haired girl, who was the subject of chronic ringworm. The drawing also illustrates the existence of mycelium in which spores have not yet formed in the shaft of a hair. It further shows how deeply in the hair the fungus grows. In these instances we have the mycelia growing close to the very limits of the horny substance, stopping

before they touch the living cells of the hair-papilla, but near enough to be favourably situated for absorption of the pigment with which the root of the hair is richly supplied.

Pathology of Ringworm of the Scalp.

Symptoms so marked as those which have just been described point to a special histology of ringworm, and a study of the histological changes necessarily leads to speculation regarding the mechanism by which the growth of the fungus has produced them.

At the outset we are met by the question of the exact anatomical position of the fungus. Küchenmeister stated in 1855, that the parasite can only live and increase in the substance of the hair-shaft itself and in the crusts which are found on the scalp; and that it is never found between the cells of the epidermis. Kaposi, on the other hand, has stated that the fungus is found between the cells of the root-sheath. In more recent times Dr. Robinson of New York has stated that conidia are found even in the perifollicular tissue; and in his *Manual of Dermatology* (p. 594) he gives an engraving, in the explanation of which he states that spores and mycelia are seen in the mucous layer and in the corium.

I am able to confirm the statements of Küchenmeister, and am unable to explain those of Dr. Robinson. The subject was carefully investigated by myself in the skin of the horse in 1878. A great many sections were examined, and in no one instance were the spores found in the rete mucosum or in the corium. They were found invariably between the hair-shaft and the inner root-sheath of the hair. The spores were seen so distinctly in these sections that if they had passed into the connective tissue or root-sheaths they would necessarily have been seen there.

Dr. Frederick Taylor presented a paper to the Royal Medical and Chirurgical Society, in which he came to the same conclusions for the human subject as those which I had come to regarding the skin of the horse. Dr. Taylor, whose studies were made on the skin of a boy who had long been subject to ringworm, and who died in Guy's Hospital of disease of the

brain, had ample material with which to work, and would certainly have seen the spores in the rete mucosum or corium if they had been present. As in the sections of the skin of the

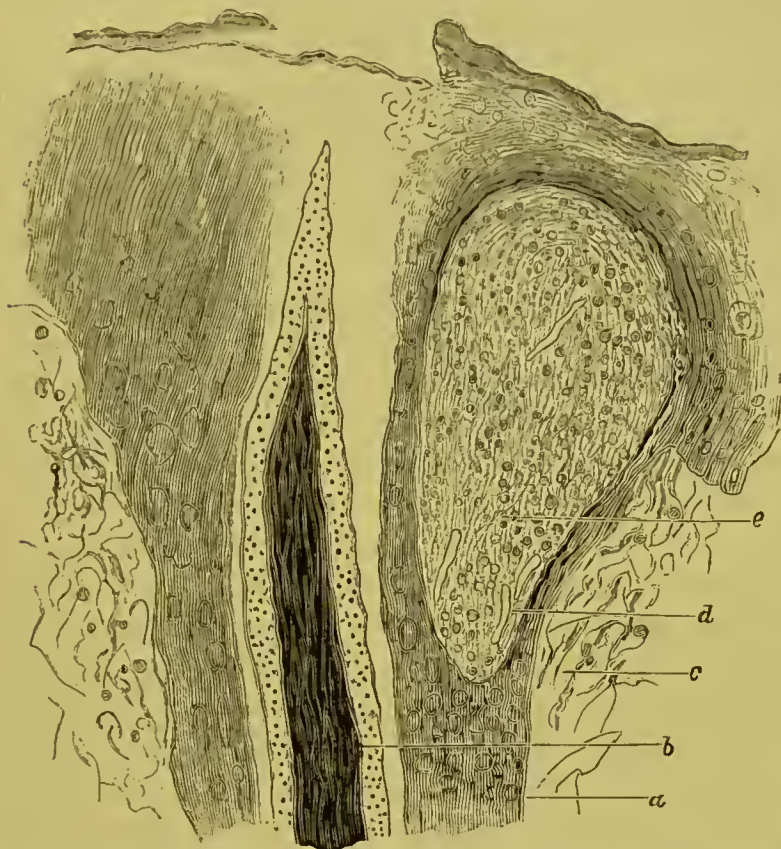


FIG. 15.—VERTICAL SECTION THROUGH A PORTION OF THE SKIN OF A HORSE AFFECTED BY *TINEA TONSURANS*: ILLUSTRATIVE OF THE POSITION OF THE FUNGUS AND THE INFLAMMATORY CHANGES IN THE CUTIS.¹

- (a) External root-sheath; (b) hair-shaft. The small dots in the clear space outside the hair-shaft represent the spores, which are lying on the internal root-sheath; (c) connective tissue of the cutis; (d) detached epithelial cells lying in a minute abscess in the rete mucosum; (e) a minute abscess cavity in the rete mucosum filled with exudation cells.

horse, so in Dr. Taylor's case, the spores were found between the hair-shaft and the internal root-sheath; and in no instance were they found in the living tissue.

¹ This Fig. as well as Figs. 17 and 18 are copied by permission of the Council of the Royal Medical and Chirurgical Society from a paper by the author "On the Condition of the Skin in *Tinea Tonsurans*," in vol. lxi. of the *Medico-Chirurgical Transactions*.

Dr. Taylor's examination and my own, therefore, entirely bear out the statement of Küchenmeister, and I believe it may be accepted that *Trichophyton tonsurans* only lives amongst epithelial cells which have more or less undergone the horny change, and that it cannot exist in living tissues.

Examination of sections from skin affected with ringworm reveals certain appearances which would not be suspected by examining extracted hairs. Within the cutis it is found that the hair-shaft becomes bent, first at an obtuse and then nearly at a right angle, and finally breaks. The lower end of the upper part of the broken shaft is pushed by the projecting straight lower part into a semi-circular form, which causes a corresponding bulging of the external root-sheath. The explanation of this is that when the shaft has become disintegrated by the multiplication of spores it bends under the pressure from below of the growing hair and finally breaks. The fracture of the shaft frequently takes place at a level with the sebaceous glands.

But very striking changes take place in the cutis and at a considerable distance from the position of the fungus. These changes are characteristic of the inflammatory process. Numbers of white blood-cells are found in and around the walls of the blood-vessels, and to a less extent between the bundles of connective tissue. They are also found, sometimes in great numbers, between the cells of the rete mucosum, which may become disintegrated and disappear.

The horny layer itself may also break down, and in extreme cases the cutis is covered with a purulent discharge. The superficial blood-vessels are found distended with blood-corpuscles, and cavities are observed in the rete mucosum filled with white blood-cells; in other words, minute abscesses form in the rete mucosum.

These histological changes afford an abundant explanation of the symptoms we have described in the section on the *Progress of the disease*. It is clear that the fungus gives rise to inflammatory or destructive processes which injure the walls of the blood-vessels, and lead to effusion sufficient in degree to produce great changes in the rete mucosum. The exact mechanism by which these changes are effected is not evident, but we may infer



FIG. 16.—FROM A TRANSVERSE SECTION OF THE SCALP OF A CHILD AFFECTED WITH *TINEA TONSURANS*, SHOWING THE POSITION OF THE SPORES.

The Fig. is based on a drawing by Dr. Frederick Taylor in vol. lxii. of the *Medico-Chirurgical Transactions*, permission to use the drawing being kindly given by Dr. Taylor and the Council of the Royal Medical and Chirurgical Society. Only half of the drawing has been copied, but it has been enlarged to double the size of the original. The spores are for the sake of clearness enlarged out of proportion.

- (a) The cells of the external root-sheath; (b) the internal root-sheath; (c) the spores, lying between the internal root-sheath and the hair-shaft; (d) the hair-shaft.



FIG. 17.—FROM THE SKIN OF THE HORSE: ILLUSTRATING THE FRACTURE OF AN AFFECTED HAIR BY THE PROJECTION OF THE GROWING SHAFT FROM BELOW.

- (a) cutis; (b) sebaceous gland; (c) external root-sheath.

that as the growth of the spores in the hair-shaft necessitates the decomposition of organic substances, some products of this decomposition are left unassimilated, and if they are soluble they will find their way between the cells of the root-sheaths to the substance of the cutis and to the walls of the blood-vessels.

The effusion of colourless corpuscles takes place around the walls of the blood-vessels even in the deeper strata of the cutis, showing a certain extension of the inflammatory process from the parts directly attacked, and adding additional proof of the irritant nature of the poisonous substances set free by the fungus.

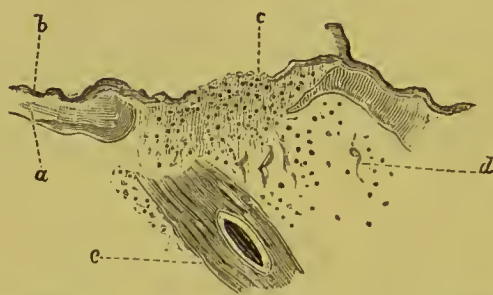


FIG. 18.—VERTICAL SECTION THROUGH THE SKIN OF A HORSE AFFECTED WITH *TINEA TONSURANS*; ILLUSTRATING THE INFLAMMATORY CHANGES PRODUCED IN THE CUTIS AND EPIDERMIS BY THE FUNGUS IN THE HAIRS.

- (a) Rete mucosum ; (b) horny layer of the epidermis ; (c) a raw surface, denuded of epidermis and covered with amorphous matter containing many exudation cells ; (d) blood-vessels distended with blood-corpuscles ; (e) a hair which was seen under a high power to contain spores of *Trichophyton*.

Does the influence of this irritant extend beyond the cutis ? In other words, is the inflammation produced by *Trichophyton* in the scalp of a child, when it involves a considerable extent of surface, and when it lasts for some time, likely to exert an injurious influence on the health of a child ? It is generally stated by dermatological writers that weak, delicate children and scrofulous children are more liable to be affected by ringworm than others. Statements of any kind are so often copied by one author from another, that it is doubtful what proportion of authors make these statements from the results of their own observations. It is a fair question whether the weakness and delicacy, and signs of a scrofulous tendency in children who are the subjects of that diathesis, are not due to the absorption by the blood-vessels

of a depressing organic poison continually being set free by the growth of the fungus. The data which would enable us to answer that question have not yet been provided. But as I am certain that the most healthy children may and do suffer from ringworm of the scalp, I am induced to believe that, if the proportion of ringworm children who are delicate is larger than the proportion of delicate individuals amongst ordinary children, the delicacy should be considered to be the effect and not the cause.

TREATMENT OF RINGWORM OF THE SCALP.

It is possible to treat ringworm of the scalp without cutting the hair, but it is always unadvisable to do so. If the hair is left uncut it is difficult to see the extent of the disease, it is difficult to apply remedies thoroughly, and it is difficult to be sure that there are not undetected patches. If there is only one or perhaps two well-defined patches it may be sufficient simply to cut the hair for the distance of three-quarters of an inch around the patch, at the same time, particularly if the patient is a boy, ordering the hair of the rest of the head to be cut very short, so as to facilitate observation.

If the patient is a girl and the parents object strongly to the hair being cut, a concession may be made, and the hair, excepting that which surrounds the area, may be left, on the understanding that the scalp shall be thoroughly examined daily by a competent person. When there are more than two or three scattered patches the whole hair should be cut.

It is not necessary to shave the head; it suffices if the hair is cut with scissors close to the scalp.

The long hairs of the scalp being thus as far as possible cut out of the way, the next thing to do is to order a preventive lotion or ointment for the whole of the head, in order to destroy any spores that may be on the surface.

A lotion of 2 per cent. solution of carbolic acid in water, or of boracic acid dissolved in alcohol, answers this purpose, and should be thoroughly applied with a sponge once daily. A simpler and equally good preventive is boracic ointment, with which, if it is used, the scalp should be kept smeared.

Having mapped out the patches by cutting the hair, and

having ordered a disinfecting lotion or ointment to prevent the spread of the disease, the next task is to endeavour to cure the patches which exist. As a rule it is not an easy task, as may be inferred from the great number of remedies whose efficacy has been the subject of more or less enthusiastic praise. When it is asserted of a remedy that it cures many ailments it may be taken for granted as very likely that it cures none, and when many remedies are recommended in the treatment of a disease it is only too probable that not much confidence can be placed in any of them. Unfortunately the latter proposition applies to the treatment of ringworm.

The many vaunted specifics only too often leave the practitioner in the lurch. Disappointed with one he grasps at another, until the changes have been rung on an endless variety of so-called cures; and at last the parents, wearied and disappointed, take their child from one medical man to another and finally come to the conclusion that the disease is incurable. I am satisfied that the best way to avoid these discouraging results is not to fly from one remedy to another but to take care that the remedies selected are thoroughly and patiently applied. When it is found that under the use of a remedy the patches not only cease to extend but the number of diseased hairs diminishes and the number of healthy hairs increases, the remedy which has effected this progress should be persevered in; the progress will in all probability be steady and the disease eventually be rooted out.

At the outset the patient's friends should be told that the disease is a chronic one, and that a rapid cure, although not impossible, is not to be confidently expected. After the practitioner has satisfied himself that the treatment is being properly applied, he should not, as a rule, see the patient too frequently, so as not to lead to the expectation of a speedy result. It is only in exceptional cases, or when strong remedies have been used, that the patient should be frequently seen.

The remedies for ringworm may be divided into two classes—parasitocides pure and simple, and irritants, although it is to be remembered that many irritants are also parasitocides.

To an unexperienced man the choice of remedies recommended in books must be bewildering. Amongst others they comprise:—sulphurous acid, boracic acid, hyposulphite of sodium, iodine,

thymol, sulphur, tar, goa powder, chrysophanic acid, menthol, oleate of copper, salicylic acid, turpentine, and various salts of mercury. Some of these substances are used in solution as lotions, some in ointments, and some in combination with glycerine. One practitioner has assured me that for many years he treated cases of ringworm successfully by the frequent application of mustard poultices. Not only are various methods used, but the fashion of remedies varies according to time and locality.

It will much facilitate the treatment of ringworm of the head if we can act in accordance with some general principle which is in harmony with observed clinical facts.

Ringworm of the scalp is not only curable but it is cured by very different remedies. If we examine what there is in common in the remedies that are known to be efficacious, we shall find that they all have the property of producing certain degrees of inflammation of the skin. If we also bear in mind that ringworm in rare cases effects its own rapid and complete cure, and that in these cases the inflammation is acute and leads to the rapid formation of pus, we find that what is common to the spontaneous cure and to the action of the well-known remedies is inflammatory action.

As long as the inflammation caused by *Trichophyton* in the hairs leads to the formation of simple scales and crusts, the disease goes on, the fungus lives and multiplies. But if from some peculiarity of the affected subject the inflammation becomes quickly purulent and extends downward to the root of the hair, the disease disappears. Inflammation, then, if carried to a certain degree of severity, destroys the fungus, and the cases of spontaneous cure in children are those in which the inflammation is sufficient in itself to lead to its destruction. In such cases permanent baldness over the affected area is the result, and the small bald spots sometimes seen on the heads of children with otherwise abundant hair are due to this cause. But in the very great majority of cases the inflammation excited by the fungus is not sufficiently acute to lead to this result.

The principle of managing the disease consists in procuring in the hair-follicles an inflammation sufficiently acute to gradually lead to the destruction of the fungus, without causing destruction of the hair-papillæ or leading to ulceration of the scalp. To do

this successfully the practitioner must consider the age and constitution of the patient, and apply his remedies tentatively at first until he discovers the degree of concentration that is suitable for the skin of the child. Age is not of itself a sufficient guide, the irritability of the scalp in different children varying very much. For this reason the patient should be seen more frequently in the early stages of the treatment than later on.

Bearing this principle in mind, we are able to understand why the list of remedies which are recommended grows continually larger. The substances that are capable in intelligent hands of effecting the necessary inflammation are practically unlimited.

In the report read by M. Besnier before the Academy of Medicine in Paris in 1884, on the *Treatment of Parasitic Affections of the Skin*, more particularly on the treatment of Tinea, the author remarks:—"In the actual state of science we do not possess a medicinal agent capable of modifying the living cells or living organic fluids in such a way as to render them unfit for the germination of the microphyte or microbe without altering these cells and these liquids in their vitality to such a point as to compromise life locally or generally."

And with special reference to the treatment of ringworm, he says, "that the applications have no other object than that of producing in the parts affected an eliminatory irritation, and that this irritation must be set up at the proper place to the degree that is required, and in necessary measure, but by no means in a manner systematic and uniform for every patient."

My own studies and experience in the treatment of ringworm are entirely confirmatory of these remarks of M. Besnier. There is no fixed formula for every case of ringworm. If too weak the application is useless, and if too strong it may destroy hair or skin. But while every case must be treated on its own merits, there are certain recognised strengths of acknowledged remedies which are suitable for the tentative beginning of treatment, and these form a basis to start with, to be modified as experience shows is required.

In further illustration of the fact that the longest and widest experience in the treatment of ringworm leads to the greatest simplicity in practice, let me quote the remarks of M. Lailler, one of the physicians of the St. Louis Hospital in Paris, and the

author of most able clinical lectures on the various forms of Tinea. After an admirable exposition of the clinical features of the disease, M. Lailler says that "the best and most efficacious means [for treating ringworm of the scalp] is certainly epilation; but as the hair invariably breaks, the epilation is incomplete, and it is in this fact that there is to be sought an explanation of the long duration of the malady. At the same time that epilation is employed to remove the hairs with the spores which infiltrate them, it is also intended to facilitate the penetration of parasitocides into the follicles. Those most employed are solutions of corrosive sublimate of different strengths: the concentration generally used varying from 1 in 300 to 1 in 1,000. Between the periods of epilating and of using lotions of corrosive sublimate, the scalp is rubbed daily with an ointment containing the yellow oxysulphate of mercury in the proportion of 1 to 30. Every day or every second day the head is washed with soap. I repeat the epilation so long as careful and frequent examinations show the presence of hairs which break. Ringworm of the scalp," he continues, "is an affection in which to arrive safely at a termination it is necessary to go slowly. After many trials and many researches we are forced to return to this method of treatment, which is after all the best and the shortest that we know. What, after epilation, gives the best results is certainly inflammation of the skin where it has been provoked by scratching, by eruptions of irritative eczema, or by other irritants."

M. Lailler goes on to say that his experiments with perchloride of iron, solutions of salt, and croton oil have been discouraging. These remedies frequently provoked an unmanageable inflammation, and occasionally left cicatrices and baldness. He adds that applications have not yet been found which with certainty will lead to a uniform degree of dermatitis compatible with the discharge of the hairs containing the fungus, and at the same time compatible with the growth of new hair.

In short, M. Lailler, after his great experience, finds that the steady application of remedies which are not supposed to act with great rapidity is better and safer than attempts to procure a speedy result by the use of strong irritants. His *Arma-*

mentarium will appear very limited compared with the multiplied and intricate formulæ found in the pages of many of our English books.

I have quoted the opinions of Besnier and Lailler, because their experience has been in Paris, where ringworm is common; and, what is still more important, in the St. Louis Hospital, where there is a regular service of ringworm children, and in which the facilities for the study of the disease and its treatment are unequalled.

The successful treatment of ringworm depending on the production of a certain degree of dermatitis, and there being many ways of producing this dermatitis, a cure may in course of time be effected by very different means. Practitioners who see much of the disease have usually fallen into the habit of relying on certain remedies in the use of which experience has made them expert.

My own method of treatment is as follows:—In a very young child, say a child under three years of age, after the head has been prepared for treatment in the manner I have recommended, I usually begin by applying simple *sulphur ointment*, in the proportion of 1 dram to an ounce. If this is well borne, as is usually the case, and the disease does not yield, I increase the strength of the sulphur. With this treatment, or without it, tincture of iodine may be used more or less successfully according to the age of the child. In a very young child the hairs are not planted deeply in the scalp, and a milder treatment which is successful in ringworm of the body may not improbably succeed. In the case of a very young child, sulphur cautiously and continuously applied will usually lead to a cure. If it fails after sufficient trial, the remedies used for older children must be cautiously applied over a surface not too large.

For children of four or five years of age, in addition to sulphur ointment, I am in the habit of prescribing a solution of *carbolic acid* in *glycerine*, beginning with a weak strength (1 in 8). If the child has a delicate skin, I combine the carbolic glycerine treatment with sulphur ointment (1 or 2 drams to the ounce), directing that the glycerine be well rubbed into the affected parts twice daily, and half an hour afterwards that the ointment be rubbed in. If these remedies produce very

little irritation and the disease does not yield, the treatment used for a child of six or seven is tentatively tried. In a child of six or seven the epidermis of the scalp has usually become strong and the hairs are deeply rooted. In children of this age and older the disease is apt to be very obstinate. It is hardly practicable to make a distinction in the strengths of the applications suitable to the different ages after seven. Some children of nine or ten have the scalp so easily irritated that they cannot bear an application which in other children of five produces little or no effect. It is at this stage that the strengths of the carbolic glycerine and of citrine ointment (when this remedy has been used) must be gradually increased. At the first sign of a suppurative inflammation or rawness, they must either be weakened, or, if the symptoms are acute, boracic ointment is substituted for a few days, until the inflammation has subsided.

I am satisfied from experience that as a rule nothing is to be gained by producing too acute an inflammation on the surface of the scalp. I have seen cases in which for weeks the surface of a patch has been raw and covered with a sero-purulent discharge without the disease yielding at all. The degree of inflammation which seems best adapted to effect a safe cure is indicated by a moderate erythema which is kept up persistently for some time.

Citrine ointment, properly handled, is, I have found, one of the most reliable remedies. I have known cases cured by it with scarcely any signs of inflammation being produced. I do not believe that this was due to any so-called parasiticide effect of the ointment, but to the production of chronic congestion to a moderate extent in the tissues around the hair-follicles. The distinction between a superficial inflammation of the scalp and a deeper-seated congestion of the hair-follicles, with very few signs of superficial inflammation, is always to be borne in mind. It is the latter effect which we wish to produce.

In dealing with older children, carbolic glycerine and citrine ointment may very fairly be tried persistently before changing treatment. Carbolic glycerine alone can be made effective.

For example:—E. R., aged thirteen, was put under my care for disseminated ringworm of long duration. The disease was in the form of raised, red, tumid, scabby patches, varying in

size from a split-pea to a threepenny piece. The patches were numerous on the back and sides of the head. He was ordered to have the places washed thoroughly once daily to remove the scabs—a part of the treatment which was very inefficiently carried out. He was treated with carbolic glycerine alone. He began with the strength of $3\frac{1}{2}$ drams of carbolic acid to the ounce of glycerine. The strength was gradually increased until it was 7 drams to the ounce. No other treatment was used. He was cured in five months. I have little doubt the cure might have been attained in a less time if the treatment had been more effectually carried out, if I had seen him more frequently, and if the carbolic glycerine had been more quickly strengthened. The applications caused a little smarting, but the treatment gave rise to no inconvenience. I have used in some instances carbolic glycerine of considerably greater strength than even in this case, but have never begun with a strong solution, and have always increased the strength tentatively and gradually.

On the other hand, citrine ointment may be used alone, and a cure be effected. The strength must again be proportioned to the age and susceptibility of the patient. In very young children, say under three, I have no experience of its use. In these cases I am in the habit of using sulphur ointment in various strengths, sometimes also using simple irritants, such as tincture of iodine. In children of four or five, I begin at once with one part of the *Unguentum hydrargyri nitratis* in six of lard or weak sulphur ointment, and continue that strength for some time, increasing it if necessary. When a large part of the scalp is affected, I think it well to treat selected portions with citrine ointment, using for the other parts a sulphur ointment of the strength of 2 or 3 drams to the ounce, the stimulating effect of which is strengthened if necessary by the addition of half a dram of carbonate of potassium to the ounce. In older children I have occasionally succeeded by applying undiluted citrine ointment to one or two patches, and have found that it is sometimes well borne, and sometimes that it has to be quickly withdrawn on account of the irritation which it produces.

Although I have never found salivation or any other ill effects produced by the application of citrine ointment in

various strengths, yet I hesitate to apply it to a very large surface, always at first watching tentatively the result, and only increasing the strength gradually.

Usually I combine both treatments. I direct that the parts should first be wiped dry and clean with a dry cloth, that the carbolic glycerine should be well rubbed into the affected hairs and round the margins of the patches. In half an hour the part is again wiped dry and the ointment is rubbed in firmly. This procedure is repeated twice and sometimes three times a day, according to the effect produced. I have described the use of citrine ointment because it is what I frequently use, but there is ample testimony to show that other salts of mercury, if properly handled, will obtain the same effect.

The *turpeth mineral*, or yellow *sulphate of mercury*, is used by French physicians successfully, and appears to be their favourite remedy, in the proportion of 1 in 30.

White precipitate ointment in various strengths is exceedingly useful. I have occasionally found good results from the formula of the late Mr. Startin, copied in Dr. Duhring's work on *Diseases of the Skin* (third edition, p. 620):

R. Sulphuris Sublimati ʒ ss.
 Hydrargyri Ammoniati gr. x.
 Hydrargyri Sulphureti Nigri gr. x.
 Misce et adde
 Olei Olivae fʒii.
 Creasoti gtt. iv.
 Adipis ʒvi.
 M. Ft. ungt.

In a case of chronic ringworm, recently under my care, in a boy aged seven, which had resisted several of the usual remedies, and in which citrine ointment was given up by the parent on account of the pain which it caused, a cure was gradually but surely effected by the use of this ointment. It had been prescribed at an early stage of the disease, and had been given up for more painful treatment. The mother fell back on it without my knowledge, on account of its not having caused pain; she used it steadily and perseveringly, and was rewarded with a good result.

In Dr. McCall Anderson's *Treatise on Diseases of the Skin* it is stated that Sir William Jenner strongly recommends an ointment composed of 20 grains of *ammonio-chloride of mercury* and 4 drams of sulphur ointment. This ointment, though likely to be efficacious, is not one which I should recommend for very young children on account of the proportion of white precipitate.

The *red oxide of mercury* ointment, weakened to various degrees, is recommended, and is also no doubt useful. I have no experience of its use in ringworm. The formula given by authors has a strength of 6 grains to the ounce.

I have latterly, particularly when I wished to avoid using a mercurial ointment, occasionally used, with the carbolic glycerine, an ointment of *sulphur* and *carbonate of potassium* (from 2 to 3 drams of sulphur to the ounce of lard, with usually half a dram of carbonate of potassium, sometimes increased to a dram). This ointment well rubbed into the head produces in some children a considerable amount of erythema with some congestion of the skin. Combined with carbolic glycerine it is as efficacious as most other remedies if perseveringly used; and where a large surface is involved has the advantage of being free from the risks of absorption.

But I have little doubt that the most potent remedy in ringworm of the scalp is a solution of *perchloride of mercury*, although on account of the dangers attending its use, if applied sufficiently freely and of sufficient strength, I have little experience of it. I have occasionally applied it in the weaker solution, 2 to 3 grains to the ounce, but have not found it very efficacious. I have hesitated to prescribe the stronger solutions, the use of which I could not control. It forms the basis of some, if not most, of certain popular remedies known by the name of the vendor.

Three children were once brought to me supposed to be suffering from ringworm. The eldest, a girl of about eight, had been treated by a lotion publicly sold as a cure for ringworm. I found a large part of the top of the head the seat of an intense erythema, the hairs on the erythematous patch very thin, and the ringworm quite cured. The lotion, which I was informed contained perchloride of mercury, had cured the

disease, but at the expense of sacrificing, probably permanently, many of the hairs.

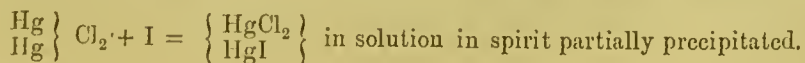
My friend, the late Dr. Arthur Reid, of Hankow, China, told me that several children in a family were under his care for ringworm for a considerable time in Hankow. The family went to England, where they remained a year, during which time the children were treated for ringworm by more than one specialist in London. They returned to Hankow, and Dr. Reid found the ringworm still uncured. He then treated them with solution of perchloride of mercury and cured the disease.

The strengths usually recommended are 1 to 3 grains to the ounce; the solution being generally in a mixture of water and rectified spirit.¹

If perchloride of mercury is used for ringworm at all it should, unless in very weak solution, be used only over a very small surface, and the effect carefully watched by the practitioner. Those who only see their patients at considerable intervals will probably act most wisely if they prefer other remedies. A number of years ago a fatal case was reported in the *Lancet*, in which death resulted from the application to the scalp of a strong solution of perchloride of mercury in spirit. The girl, who was otherwise well, suffered from ringworm of the scalp, for which the perchloride was applied. Profuse salivation occurred, and the patient died as a direct result of mercurial poisoning. It appeared from the correspondence to which the report of the case gave rise, that similarly strong solutions had been used in other cases without any untoward result, but I am not aware that since that time authors have generally ventured to recommend the application of

¹ Some years ago, a girl who was under my care for ringworm, and in whom the disease had resisted the most thorough and persistent use of oleate of mercury, was sent to Scotland, where she got rapidly well under the care of a friend in Edinburgh. I enquired how he had effected the cure. He informed me that it was effected by a preparation formed by mixing calomel and tincture of iodine in a certain way, which he had learned from a medical man in the country to whom he had formerly been assistant.

The formula was examined by Messrs. Savory and Moore, who reported to me that the product was a strong solution of perchloride of mercury, a stronger solution than my friend would probably have used had he used it wittingly.



perchloride solution in anything like the same strength. Dr. McCall Anderson, indeed, in his *Treatise on Diseases of the Skin* (p. 494), states that he has tried the application of a piece of lint soaked in a solution of perchloride of mercury in the proportion of 10 grains to the dram of alcohol, and kept *in situ* for a couple of minutes. He says he does not "use this much now, as there is some risk of salivation, although the bichloride when used as a vesicant seems, as a rule, to have much more of a local than a constitutional action." This is a stronger solution than was used in the fatal case to which I have alluded, and that it has been applied in a number of cases shows what may be done without harm, but is not a guarantee that grievous injury may not unexpectedly result at any time from the use of such a strong remedy. My own opinion is against the use of such powerful remedies, and I advise practitioners not to allow the inconveniences of a protracted case of ringworm to induce them to use such strong solutions of perchloride of mercury. The disease never warrants the use of remedies which involve the slightest danger to health or life.

On the whole, I believe, in ordinary cases of ringworm, with more or fewer scattered patches over the head, and probably with isolated diseased hairs, the best plan is to continue a treatment with carbolic glycerine and an ointment containing citrine, or white precipitate ointment, the strength of both glycerine and ointment being proportioned to the age and strength of skin peculiar to the patient. A little observation of each case teaches the necessary strengths. This treatment prevents the spread of the disease, and if continued for a sufficiently long time will, in the great majority of cases, effect a cure. Patience, however, is required both on the part of the parent and the practitioner. If this patience fails what is next to be done? I advise in such a case that small selected patches be treated by some of the more vigorous methods which are warrantable when the disease is confined to one or two small spots. This leads me to consider what is the best method of treating one or two small spots.

Let us take an example. A boy of ten, attending a public school near London, was brought to me with a patch of *Tinea circinata* on the nape of the neck. This was of course easily

cured, but the gravity of the case consisted in the discovery of a small patch of ringworm of the scalp, scarcely the size of a threepenny piece, on the vertex. The boy was of course immediately removed from school, and the question was raised, as usual, how soon could he be allowed to return. The patch was repeatedly blistered with blistering fluid. For two days after being blistered it was dressed with boracic ointment. Undiluted citrine ointment was then used twice daily. As soon as the skin had completely recovered from the effects of the blistering, the surface was blistered again. The result was a cure in less than three months, and the absence from school was limited to one term. The disease of course did not spread. Treatment of this kind, which would be severe in a very young child, or in any young person over a large surface, is really of very little moment over a small area in a strong boy of eight or ten.

Some years ago I tried the effect of simple *fat*. For two months two patches on the vertex of a boy, each about the size of a shilling, were kept persistently covered with a thick layer of fat. The disease did not spread at all, but it did not in the least get well. I then painted the patches repeatedly with *Coster's Paste* (a solution of iodine in creasote), making the applications myself. A cure was gradually effected in a comparatively short time, and no baldness followed.

Blistering acts in two ways. It acts by setting up inflammatory action in the hair-follicles, and it also acts by removing the horny layers of the epidermis, and thus increasing the irritating effect of ointments which are usually combined with it. Blisters should never be used over a large surface, nor would I use them at all in young children. Of course the effect of a mercurial ointment is increased when applied to a blistered surface, and the risks of absorption are greater. It is certain that although salivation is produced in rare cases, it is not at all a common result from mercurial ointments applied to the scalp in the strengths generally used.

There are two objects to be kept in view in treating the disease. The first, which is not difficult to attain, consists in resisting its spread. The second is to get rid of the diseased hairs, and produce a growth of healthy hairs in their place. When the

stumps become fewer and the new fine hairs more numerous, we know the disease is getting well, and any treatment which produces this result should be patiently and perseveringly continued. If the disease makes no progress or if it is advisable to change the treatment, what choice is to be made amongst the numerous class of remedies recommended? First of all it is well that we should recognise wherein the difficulty of cure consists. If we extract one of the stumps from a patch that has been long under treatment and put it under a microscope, we shall find that the spores are destroyed to a point which is considerably below the level of the opening of the hair-follicle. This is made still more clear if we cultivate some of these hairs on meat gelatine, when the appearance shown in Fig. 19 is observed.

It will be seen that no growth of mycelium has taken place in the part of the stump corresponding to the upper layers of the corium, while we find mycelia growing freely from the root. This condition may be found in hairs from patches which have been many months under treatment. It is the destruction of these deep-seated spores that we are forced to attempt.

A method frequently employed by experienced men is epilation, which was introduced by Bazin and is still followed by the French school, and insisted on by many authorities in all countries. I at one time steadily tried this treatment, often practising it myself; but was disappointed with the result. The treatment was painful and irksome, and I was unable to satisfy myself that the advantages were sufficiently marked to encourage me either to practise or recommend it. Practically it does not remove all the fungus. The hair breaks and leaves within the skin the part in which the spores have not been destroyed by treatment. Even if the stump is removed entirely, the spores which are adherent to the root-sheath are not removed. I am not sure even that the alleged advantage of its permitting the remedies to enter the follicles easily is more than hypothesis. The follicle probably becomes occluded until opened up afresh by the growth from below. It is quite conceivable that the presence of the hair in the follicle may facilitate the passage of ointments between the shaft and the sheath by keeping the follicle open. Extraordinary feats have been done in the way of epilation.

Dr. Bulkley relates that he and the mother of a little girl seven years old, extracted 33,850 hairs from the head of the latter. I was recently consulted in the case of a boy aged eleven, whose aunt, an active intelligent woman, assured me that in her



FIG. 19.—A RINGWORM HAIR AFTER LONG TREATMENT, CULTIVATED ON MEAT GELATINE, SHOWING THE DEPTH TO WHICH THE SPORES HAD BEEN DESTROYED OR STERILISED.

At the root of the hair mycelium is seen growing freely.

a, point of exit from the scalp.

b, *Trichophyton* developing from the root.

despair at the long duration of the case she practised epilation until she had extracted every hair in the boy's head (a head which I may say contained an unusually large number of hairs). The disease was not cured by the process. Although I do not

speak encouragingly of epilation from my own experience, I am bound to emphasise the fact that the procedure is supported by the very highest authorities.

The origin of the use of *spirit lotions* is due to the idea that parasitocides can be made to penetrate more deeply if the fatty matters of the hair-follicles are dissolved. Dr. Cavafy has advised a solution of boracic acid, 20 grains to the ounce of alcohol, to which a dram of ether is added. The solution is firmly rubbed into the part three times a day, the whole head being washed every morning with soap and warm water—a method of treatment also commended by Mr. Alder Smith. Alcoholic and ethereal solutions of carbolic and salicylic acids had been previously recommended by Kaposi, but, as Dr. Cavafy remarks, these substances are much more irritating than boracic acid. I have little doubt that when a good result is obtained by these solutions, the result is due to the alcohol. Carbolic acid, and salicylic acid in alcoholic solution are so powerful, unless in very small proportions, that there is no doubt that they can in this medium be so used as to have a decided effect. But with the weak solutions in which it would be alone safe to employ them, the result must, I think, be set down mostly to the action of the spirit. Alcohol well rubbed into the parts three times a day will cause a certain amount of congestion, and an addition of boracic acid in any case cannot hurt. The treatment is a clean one, and although it is hardly conceivable that the boracic acid can be carried down to the root of a hair such as is shown in Fig. 19, the requisite degree of persistent congestion of the follicle may be attained by this means.

Oleate of mercury was so strongly recommended by some authors a few years ago, that the highest hopes regarding it seemed justified. One author wrote stating that he had cured forty cases with an ointment of 10 per cent. oleate of mercury with $\frac{1}{7}$ acetic ether. I gave the remedy a fair trial, and came to the conclusion that, while undoubtedly a useful agent, it had no advantages over the older treatments by mercurial ointments. Like Dr. Bulkley, I have seen considerable inflammation caused by it without the disease being cured. Mr. Alder Smith has spoken highly of it; his formula is—

R Hydrargyri Oleatis ʒss. ad ʒi
(Dr. Shoemaker's)
Adipis Benzoati ʒv.
M. Ft. ungt.

Oleate of copper has been recommended by Dr. Le Sieur Weir. It is used in the strength of 1 to 6 drams in an ounce of vaseline. As it sometimes causes a good deal of irritation it is best to begin with a weaker strength. I am not aware that the brilliant results claimed by Dr. Weir have been confirmed by subsequent observers, but there is no doubt that oleate of copper may take its place amongst the other irritants which may be successfully used in ringworm of the scalp. Dr. Shoemaker also recommends it, and deprecates the use of water to the affected parts while it is being used. Mr. Alder Smith states that he has been pleased with the results which he has obtained from it. Dr. Liveing¹ reports that it was fairly tried for twelve months in nearly all the patients who presented themselves in the out-patients' department in the Middlesex Hospital (over one hundred cases); and that the results did not come up to his expectations. The use of copper (for example, rubbing with a penny which had been soaking in vinegar) is an old-fashioned remedy. The following incident occurred in my practice.

I was treating a boy very successfully with carbolic glycerine and an ointment of sulphur and carbonate of potassium. The number of diseased hairs at each fortnightly consultation was steadily diminishing, and I was well satisfied with the result. The parents were, however, very impatient to be able to send the boy back to school, and the nurse, at her own instance, expedited matters. She put half a pound of sulphate of copper in a pint of vinegar. After a few days she took the crust which had formed on the sulphate of copper and rubbed it firmly into the affected parts. The result was that the few remaining diseased hairs disappeared, but the treatment had produced rather a violent erythematous inflammation, an inflammation considerably more intense in degree than had been produced by my remedies. When I saw the boy I found the skin very red

¹ *Brit. Med. Journ.* 1884.

and fiery, although the inflammation was stated to have abated considerably. However, the case remained well.

Tar has long been used in ringworm, and as it has a special power of penetrating hair-follicles and exciting inflammation in them, one would *a priori* have expected striking results from its use. It cannot, however, any more than other remedies, be considered specific. A solution of iodine and tar (Coster's Paste) has often been found useful, the formula being Iodi ℥ii, Olei Picis Liq. ad ℥i. After the scab which the application produces can be removed, the remedy may be applied again.

Undiluted *Huile de Cade* (Oleum Cadini) may be painted on the patch, or it may be incorporated with an ointment. If any good is to be expected from this treatment it must be applied frequently, and followed up persistently.

Iodine. Whilst in very young children tincture of iodine will sometimes cure the disease as readily as it cures *Tinea circinata*, and for the same reason, namely, because the hair-follicles are not deep, in older children it usually disappoints. I have known not only tincture of iodine but *Linimentum iodi* repeatedly used without effect. It belongs to the class of remedies which produce considerable superficial inflammation without exciting irritation at the root of the follicles.

Chrysophanic Acid and *Goa Powder*. The strikingly good effects produced in ringworm of the body, and more particularly in inguinal *Tinea* by Goa powder, led to extravagant expectations from its use in ringworm of the scalp. These expectations have not been fulfilled, although, from its power of producing cutaneous congestion, it can undoubtedly be used in such a manner as to cure some cases of ringworm. Yet it often fails, and it has the great disadvantage of producing an erythema that occasionally spreads over the face and neck, causing great alarm to the patient's relatives, as well as to the practitioner. In whichever way it is used, whether as mixed with chloroform or in the form of an ointment, I do not think its superiority to other remedies outweighs its disadvantages. Mr. Alder Smith prefers the Bombay Goa powder to ordinary Goa powder or chrysophanic acid, and considers that in certain cases it is worth a trial. I have seen so much alarm produced by its use, that I never prescribe it.

Boracic Acid, *Thymol*, *Iodoform*, *Eucalyptus*, are remedies which, being antiseptics, have been tried and more or less recommended. An antiseptic, as such, is useless in ringworm of the scalp; and these and other antiseptics are only useful in so far as they are combined with other substances which stimulate the blood-vessels.

Salicylic Acid in ointment ($\frac{1}{2}$ dram to 1 dram to the ounce) or in oil, still more in spirituous solution, may be made to have a very stimulating effect on the scalp, and in some cases the ointment is convenient and leads to good results.

Turpentine has been used in treatment of ringworm of the scalp. It can of course be so used as to produce inflammation enough to cure the disease, but I do not think that can be conveniently done. I do not consider it one of the manageable remedies.

Pyroligneous Acid and ordinary strong *Acetic Acid* are old remedies for ringworm, being used on the principle of "stamping out" the disease. No doubt they can be used in such a manner as to succeed. But there is no reason to suppose that they have any advantage over other strong local irritants. If used at all they must be used over a limited surface, and their action confined to the part directly affected. They should be painted lightly in the same manner as blistering fluid, and the part subsequently treated as if it had been blistered. The best that can be said for this treatment is that if cautiously employed it is not likely to cause baldness. But the chances of its promptly cutting short the disease are very small indeed. If vesicants are used at all, I prefer *Liquor epispasticus*. M. Monique,¹ whose observations were made in the service of Lailler, states that pyroligneous acid is useful, and does not produce baldness, while M. Thomas² relying on twenty-six observations of cases states that it may cure, but that its action is not constant, and that it may produce accidents such as dermatitis and alopecia, like croton oil and other strong topical remedies.

Croton Oil has been long used in France, where, after having been thoroughly tried, it has been condemned by the best authorities. Dr. Ladreit de Lacharrière manufactured pencils containing croton oil, suitable for rubbing over the affected parts.

¹ *Thèse de Paris*, 1883.

² *Ibid.*

Croton oil produces an intense and often a suppurative inflammation of the hair-follicles, which there is no doubt frequently produces a cure, but by no means quickly, and certainly not always. The procedure after being tried experimentally at the St. Louis Hospital, was rejected as inefficacious and dangerous. It was considered dangerous because the suppuration of the hair-follicles might determine permanent baldness, and inefficacious because recurrences of the disease were observed in patients treated by Dr. Ladreit de Lacharrière himself and discharged as cured. M. Cadet stated that by croton oil he obtained twenty-one cures in thirty-two cases; the extreme duration of treatment was eleven months, but in seventeen cases it did not exceed six. In three cases it caused permanent baldness. The average duration of treatment was three months. M. Massey states that erysipelas followed the croton oil treatment in an average of four cases out of a thousand. All the advocates of croton oil recommend that it should be applied very cautiously, sparingly, and over a limited surface, and followed by poulticing. The application of the oil should be repeated according to circumstances, the object being to produce artificial kerion. I do not enter further into particulars regarding its use, because I disapprove of the treatment altogether. I have seen in my own practice the treatment successful in curing an old-standing and obstinate small patch, but I have also in my own practice seen a bald patch twice produced and permanent disfigurement caused in consequence. I do not consider that the advantages claimed by the most enthusiastic advocates of the treatment would counterbalance the risks of such a result. I strongly dissuade any practitioner from using croton oil in ringworm. It may be urged that baldness is a result of want of expertness. It may be so, but where the personal equation comes in so strongly, I do not advise any one to be so self-confident as to believe that he can exclude risk.

A treatment analogous in principle to that of blistering and the use of mercurial ointments has been recommended by Mr. Harison of Clifton. Mr. Harrison softens the epidermic structures by a solution of potash and then applies a solution of perchloride of mercury, and claims great success from the treatment. He mixes *Liquor Potassae* and spirits of wine

in equal proportions, and adds half a dram of iodide of potassium to the ounce of the mixed solution; this he calls his No. 1 solution, which he states must not be applied to the scalp for more than a few minutes. He dabs on the solution with a pledget of lint soaked in it, and applies it to the scalp for three or four minutes at a time. When this has been done two or three times at intervals of two or three days he uses what he calls his No. 2 solution and applies it for the first time in ten minutes after using the No. 1, and then re-applies his No. 2 two or three times at two days' intervals. His No. 2 solution is made by dissolving 4 grains of mercuric chloride in equal parts of spirits of wine and water to make an ounce. After having applied the two solutions he waits a few days without using any remedy, unless it be a little cacao-butter to facilitate the removal of any scabs which may have formed, and then commences the treatment over again with this difference, that he now applies the potash solution once and follows it up with a mercuric one, very often using both at the same sitting with an interval of ten minutes between. The hairs are kept short. In severe cases the scalp must be divided into sections.¹ The treatment is likely *a priori* to be a successful one, combining as it does the action of two powerful irritants, and by softening the superficial layers of the epidermis increasing the susceptibility of the skin to the perchloride. I do not maintain that skilfully managed this treatment cannot be used without risk, but there are so many elements which enter into the successful use of such a powerful remedy that, for my own part, I should not use it unless over a surface so small that permanent baldness would be of no consequence.

I was recently consulted in the case of a boy in whom an inveterate ringworm had long resisted treatment. I found a bald patch on the back of the head about an inch square, which had resulted from the treatment recommended by Mr. Harrison, whilst the disease had not been cured in the other parts of the head. In this case at least no exception could be taken to the administrators. The boy was under the care of an experienced physician and a trained nurse. Like the treatment by croton oil, the combined treatment by solution of potash and

¹ *British Medical Journal*, December 5, 1885.

perchloride of mercury is a method that, however successful it might be in a large number of cases, I would neither use nor recommend, as it is not free from the risks of excessive dermatitis and partial baldness.

Electrolysis has been suggested by Mr. Alder Smith for the removal of isolated stumps. It is likely to be useful in cases where only a small number of hairs are affected, and where it is desirable, in order for example to enable a boy to return or get admission into a school, that he should be rapidly placed above suspicion. The sensation caused by the operation is so disagreeable that I have known it impossible to persuade a boy of seven to submit to it; but with older boys it is more practicable. Electrolysis gets rid of the diseased hair by destroying the hair altogether. The hair will never be replaced. It is evident then that it can only be applicable to a very few hairs and therefore in very few cases. The operation in itself is not difficult, only a little practice being required. I have used it repeatedly for the destruction of hair in adults. Even a nervous woman will remain perfectly quiet during the process. The scar that is left is so slight that it is barely perceivable on close scrutiny; and if the action of the electrolysis is not carried to an unnecessary degree, scarcely any scarring is left at all.

I employ a Stoehrer's battery, using from ten to fifteen or sixteen cells according to the effect, the time occupied in destroying the hair being from twenty to sixty seconds. The average time is thirty to forty-five seconds. This is an operation in which practitioners may acquire the requisite dexterity with very little practice. The first attempts should hardly be made on a patient under treatment. Those who are not familiar with the use of electrolysis may study its effects in the web of the foot or in the eye of a newly-killed frog. Its action on hairs may then be easily practised on the operator's own arm, and the experiment requires no great courage or endurance. I use an iridio-platinum needle. This operation, for which we have to thank the ingenuity of our American cousins, is rapidly passing into general use, and is the only method suitable for the destruction of the hairs, which on the upper lip, chin, and sometimes the thorax of sensitive women, are the cause of so much misery.

When from the age of the child or from any other reason,

electrolysis is not available for the removal of isolated stumps, the best treatment (so far as my own experience shows) is to blister the individual hair-follicles repeatedly with a drop of *Liquor epispasticus*, rubbing between the intervals of blistering, after the first two days, a small quantity of citrine ointment, the immediate dressing after the blister being boracic acid ointment.

A question has arisen as to whether it is wise to wash the head of a child suffering from ringworm, the fear being that in the washing the spores may be carried over the head. I have not known this occur, and am of opinion that washing the head with soap and water is good, more particularly washing with soft soap. I believe that washing with soft soap is in itself an effective remedy, and it certainly facilitates the action of other remedies which are applied.

Does ringworm of the scalp ever get well spontaneously? This is a question which I do not think can in the strict sense be answered decisively. We know that the disease may last for years, and that it gets well spontaneously at puberty; but I am not aware of recorded facts which prove definitely that it undergoes spontaneous cure. At the same time I am disposed to believe that it does so, and it is quite possible that many of the recoveries attributed to methods of treatment are really due to the fact that the remedies prevent the extension of the disease to unaffected hairs, and that the fungus, having exhausted the soil, or altered its soil, eventually succumbs. The question is well worthy of careful study and observation, and it seems to me that some of the remarks made by the distinguished French physicians, whose words I have translated in an Appendix, are specially suggestive in this direction.

APPENDIX.

On the French Treatment of Ringworm of the Scalp.

Through the kindness of M. Vidal I am able to give an account of the treatment pursued by M. Vidal, M. Lailler, and M. Besnier, physicians to the *Hôpital St. Louis*, Paris.

These gentlemen have acquired their experience at the St. Louis Hospital, where, since the days of Bazin, unceasing attention has been given to the nature and treatment of the various forms of Tinea, the frequency of the disease in Paris being such as always to ensure the attendance of a number of patients in the wards and in the out-patient departments. I consider it a privilege to be able to present to English readers a translation of the letters sent to me by M. Vidal.

M. Vidal states that:—"In Tinea tonsurans I employed for a long time the treatment of Bazin, which is that followed in the out-patients' department of the hospital, and which consists, as you know, in epilation, application of a solution of perchloride of mercury (1 in 500) and ointment of turpeth mineral (1 in 60). Average duration ten to fifteen months. I have tried extensively the treatments without epilation and the treatment of Cramoisy. I soon gave up using the pencils of croton oil, the folliculitis which they caused, with cicatrices and destruction of the hair in the suppurating follicles, producing baldness. The method is one of epilation by inflammation, or destruction of the cryptogam by pus, as in kerion. In some cases very small patches can be thus cured in three to four months, but relapses are frequent even when turpeth-ointment is employed at the same time. I have tried oxygenated water with an apparent amelioration but without definite results. The disease re-appeared as soon as I ceased the treatment. I have tried a modified form of the treatment with essence of turpentine, then tincture of iodine, then an ointment of carbolic acid, but a cure did not follow in six weeks as the originator of the method said would be the case; a cure was not effected even in three months. I gave up the treatment. I have tried iodine vapour either in

¹ *I.e.* treatment by croton oil.

the first instance or after having decolorised the hair by means of oxygenated water. I hoped to cause the iodine vapour to penetrate the hair-follicles. I used iodised wadding, after having the head shaved, applying it to the skin so as to avoid too irritating an action. I obtained in this way rapid amelioration and appearances of cure, but after six weeks to two months' cessation of the treatment the disease reappeared. I have tried, without result, preparations of glycerine with calomel or even with perchloride of mercury.

"For the last four years while continuing my experiments on treatment without epilation, I have tried a treatment by simple fats, renewed twice a day. I have tried lard and butter; now I am using vaseline. Without entering into the details of all the modifications which I have made, the method which I employ at present is the following:—The hairs are cut very short, as short as they can be cut with scissors; I rub the scalp with essence of turpentine, then I paint with tincture of iodine (with the object of destroying the parasites which are situated in the epidermis). The following day the whole head is covered with a coat of vaseline, then a thin india-rubber cap is put on, or a cap of bladder, or a very thin sheet of gutta-percha. Morning and evening the dressing is renewed; the head, and the cap which is used as a covering, being carefully wiped. I have obtained by this treatment cures in five or six months, and after three months one might imagine in some cases there was an actual cure. But it is difficult to secure that a treatment which demands so much care and attention is followed very conscientiously. I only prescribe it in my private practice and in my wards in the hospital under my own eye. For the out-patients I prescribe it rarely, and only when I have reason to hope that they will be cared for by intelligent people who will make the two applications daily.

"The hypothesis on which this treatment is founded is the following: It removes the parasite in proportion as it arrives on the surface of the skin and prevents its propagation. The hairs infiltrated with spores, which having broken could not be extracted, have time to be loosened and eliminated. Further, *Trichophyton*, being a fungus that requires air, is placed in unfavourable conditions, the layer of vaseline and the imper-

meable cap preventing its coming into contact with the air; it thus lives in a medium in which it does not find the quantity of oxygen necessary to its vitality. For the other patients in my *polyclinique*, and also for those who having commenced the treatment have not carried it out regularly, I follow the treatment of Bazin—epilation, lotions of corrosive sublimate, and application of turpeth-ointment. This is also the treatment used by Dr. Fournier in his wards and in his *polyclinique*.”

M. Lailler writes :—“The treatment which I employ at present is the following : Epilation repeated once in three weeks or once a month according to indications. Morning and evening frictions with linen soaked in the following solution :—

“ Water	950 grammes
Glycerine	50 „
Perchloride of Mercury	} à à 1 gramme.
Chloride of Ammonium	

“After the friction has been made, the head is covered with a linen cloth which has been used for the purpose before, and above that is worn a cloth cap. This is perhaps the least bad of all the treatments I have tried. I now only wash the head once a week. The mean duration of treatment is twelve to fifteen months.”

M. Besnier states that he “practises epilation of the healthy hairs which surround all the patches, or all the suspicious points, and keeps this zone epilated during the whole period of treatment. (It is quite exceptional to find that the disease spreads from one hair to another beyond the line of circumvallation made by the epilation, when this epilation is really carried out amongst the healthy hairs during the whole period of treatment.) The head is washed every morning with warm water in which boracic acid is dissolved, in the strength of 5 in 1000, and soap is added if the state of the head permits it. Every evening an ointment is lightly rubbed in composed of vaseline with a very minute quantity of sulphate of copper (from 0·05 to 1 per 1000), the friction being managed in such a way as never to cause dermatitis.

“This condition is to be considered absolute, and if the skin of the patient is irritable, and if there are eczematous points,

whether caused by the fungus or not, I limit myself to rubbing in a pomade of vaseline, or of fresh butter with 5 per cent. or even less of boracic acid. The lotions and ointments have no other object than to sterilise the healthy hairs and to render them unfit for the growth of *Trichophyton*. Ringworm patches, once isolated by the line of epilation, cure spontaneously after a few months. No medicinal substance can destroy *Trichophyton* without exciting a dermatitis in the hair-follicle to a dangerous extent.

"There does not exist any parasiticide properly so-called for the parasitic fungi of the skin. For patients who have a delicate skin all irritants are hurtful. In those who have not this peculiarity, the elimination of the affected hairs is favoured by local applications of tincture of iodine or of tincture of iodine mixed with chloroform or with strong acetic acid, repeated according to the effect produced.

"The applications ought to be made and their effect watched by the medical man himself.

"I possess notes of the cases of a great number of patients treated elsewhere by irritants who bear the indelible traces of the unhappy intervention of the medical man, and this in an affection in which a spontaneous cure is an absolute rule.

"The duration of *Tinea tonsurans* is always long—from two months to two years. I do not admit as cures cases in which the cure is not established by the microscope. Nine-tenths of the patients whom medical men send back to school as cured are not really cured, as the microscope shows, and this is an essential cause of the propagation of the disease. To resume, I make no pretension in my treatment to destroy *Trichophyton* once developed in the hair-follicle.

"I only seek to limit its extension by isolating the patch or patches by means of epilation, to sterilise the parts not yet affected by preserving them from every cause of irritation, and from all traumatism which favours extension by auto-inoculation and by using the lotions or ointments either simple or slightly impregnated with copper, which I consider best adapted to sterilise hairs against the growth of *Trichophyton*."

CHAPTER IV.

TINEA CIRCINATA (RINGWORM OF THE BODY).

TINEA CIRCINATA is a superficial inflammation of the skin produced by the growth of *Trichophyton* in the horny layers of the epidermis and in the shallow follicles of the fine lanugo hairs.

The chief characteristics of this inflammation are its superficial character and its tendency to assume a marginated circular form. The degree of the inflammation and the progress of the eruption are not uniform. In young persons or in persons with delicate skins it spreads quickly. In persons with hard dry skins it is very probable that it is not capable of developing at all.

The most common seats are the face, neck, more particularly the back of the neck, fore-arms, and back of the hands; that is to say, in parts apt to be infected by spores from the head when ringworm exists there, or from contact with affected animals, or children. Nurses, or attendants on young animals which are affected (such as calves and young horses), get the disease on their fore-arms.

The eruption begins in an erythematous spot which very soon shows scales. The spot extends as a ring, and on the margin of the ring the scaling is usually more marked than in the centre. The inflammation is therefore more acute on the margin, the soil last infected, a kind of tolerance being established in the centre of the spot. There is always an attempt at the formation of vesicles; that is, vesicles are usually found in the margin, and their size and number indicate the degree of inflammation. Sometimes they are exceedingly small, and when they give way show no appreciable fluid. At other times they are so large, full, and numerous, that they form a raised abrupt ring, from any part of which fluid exudes when it is pricked. In rare cases the appearance of successive rings can be detected, one within the other; but this is not very common. The size of the rings,

as they usually come under observation, is generally from a sixpence to a florin, but the rings are often well marked when not larger than a split pea. There is really no definite limit to the extension. The coalescence of two or more rings produces patches of a gyrate or festooned appearance.

The detection of ringworm on the neck or face of a child should at once lead to a careful examination of the head, where the source of infection will usually be found. Unlike ringworm of the scalp, ringworm of the body occurs in adults as well as in children.

The fitness of the soil for the development of this disease varies in different individuals, and in different parts of the body



FIG. 20.—TRICHOPHYTON TONSURANS, AS SEEN IN SCALES FROM *TINEA CIRCINATA*.

(Copied from Cornil and Ranvier's *Manuel d'histologie pathologique*.)

of the same individual, which is probably the reason why we rarely find the patches extending beyond a moderate size. The growth of the fungus seems in most instances to come to a stop; and after a time appears to wear out the soil, and to gradually cease from want of nourishment.

The detection of the fungus is very much more difficult than in ringworm of the scalp, and sometimes requires considerable perseverance. It is most readily found in the scales of the

periphery. The method of examining the scales is the same as that for the hairs. The mycelial nature of the fungus, however, is in this case evident.

The disease has been experimentally inoculated by several observers, amongst whom Dr. Edward Wigglesworth may be cited. Dr. Wigglesworth¹ reports that a gentleman inoculated his arm with hairs and scales from the head of a child on December 18th, 1873. On January 25th there was a circle of *Tinea circinata* as large as a silver "half-dime." On February 8th everything had returned to its normal condition without treatment. Another gentleman on October 5th, 1877, inoculated the flexor surface of the left arm with scales from a case of *tinea tonsurans* and *tinea circinata*. On October 16th the patch had extended to 1 cm. in diameter, the border being slightly raised into a papule. On November 3rd the patch was 3 by 3½ cm., the appearance being that of a typical ringworm, and the microscope showing spores of mycelium.

Diagnosis.

The diagnosis is usually not difficult. The want of symmetry and the localisation, the eruption being present usually on one part of the body only, are the leading points. These features, with its abrupt border, distinguish it from a simple scaly *Eczema*. When occurring on the back of the hand it is distinguished from *Herpes circinatus* by its being limited to one side. There is a stage when the spot resembles a patch of an acute eruption of *Psoriasis*; but the limitation to one part distinguishes it. In a few days the thin fine scales in the centre have assumed a different aspect from the heavier and more imbricated scales of psoriasis.

The only form of *Syphilis* with which it could be confounded is the stage of secondary eruption, but the secondary syphilitic eruption which it might resemble is generally a syphilitic roseola, and does not scale, and in syphilis the distribution is more general over the body.

The yellow cups of *Favus*, and the brown desquamating cuticle, without redness and without vesicles, of *Tinea versicolor*, with the large affected surface or number of patches peculiar to

¹ *Archives of Dermatology*, 1878.

the latter disease, are sufficient to distinguish them from ringworm of the body. Indeed, the only two diseases with which I can imagine its being easily confounded are *Eczema* and *Herpes circinatus*; and when the characteristic features which have been described are not sufficient to establish the diagnosis, a patient search with the microscope will, if the disease is parasitic, demonstrate the presence of *Trichophyton*. The itching usually present, more or less, varies so much that the symptom is hardly available in making the diagnosis.

Treatment.

The treatment of body ringworm is usually as satisfactory as that of the head is troublesome.

If the patch is painted once or twice with tincture of iodine, and well scrubbed with soft soap, the disease is cured. To make sure, the patient may be ordered a white precipitate ointment to be rubbed in once a day.

M. Vidal writes me that since 1861 he has preferred, to all other treatment which he has tried, painting with tincture of iodine. He applies iodine over a space extending three-eighths of an inch beyond the ring every morning for three days, then applies it twice afterwards at intervals of two days. He finds two applications usually sufficient. If any irritation is caused he applies it after an interval of two days.

M. Besnier adopts a somewhat similar plan. He rubs the patch very firmly with cotton which has been soaked in tincture of iodine, applying this treatment both in the erythematous and in the vesicular form. He usually finds one application sufficient. A second friction is necessary when the peripheral zone has not been treated sufficiently actively.

CHAPTER V.

INGUINAL RINGWORM (ECZEMA MARGINATUM).

THIS form of ringworm is so different from the two others, that it was first described by Hebra as a form of eczema under the name of *Eczema marginatum*. The term *marginatum* calls attention to a diagnostic point between the parasitic and a simple eczema.

Koebner first showed that the disease is due to *Trichophyton*.

The tender skin of the inguinal region, and the moisture of the parts, favour the development of the fungus. Starting from the scroto-crural fold, the disease advances over the inner aspect of the thighs, and extends backwards over the gluteal regions. The large rings sometimes meet in the lower part of the lumbar regions, but usually do not extend so far, the affection limiting itself to the moist skin of the inner aspect of the thighs. The affected surface is more or less red, sometimes very little so, and slightly scaly. The margin is abrupt, raised, and much more scaly than the centre. As in ordinary ringworm of the body, sometimes traces of previous margins are observed within the outer one.

The disease is very common in certain tropical countries, where it is usually known by a special name for each locality. Thus we hear of "Chinese ringworm," "Burmese ringworm," &c. As it is supposed to be, and probably is, conveyed by native washermen wearing drawers which have been sent to wash, it is also known in these countries as "Washerman's Itch," "Dhobie's Itch," &c. It sometimes causes considerable itchiness and irritation, and may last for many years; and, unlike ordinary ringworm of the body, is very rebellious to remedies.

In these respects it differs from ordinary ringworm of the body. It is also noteworthy that it is never endemic amongst a group of persons, as in a family or school, and is practically not contagious. The diagnosis is easy and consists in the

association of the abrupt raised margin of *Tinea circinata* with the irritation, desquamation, and vesicles of eczema.

The treatment consists in the frequent and firm application of certain irritants. I am in the habit of prescribing washing with soft soap twice daily, and rubbing in Wilkinson's ointment, as modified by Hebra.¹ This treatment is somewhat painful, but any treatment that is effectual in this disease must stimulate with some severity.

Kaposi recommends the application of a 1 per cent. solution of naphthol in alcohol and a 5 per cent. naphthol ointment. Tar, iodine, solutions of perchloride of mercury, are all used more or less by practitioners, tincture of iodine, perhaps, more frequently than the others.

In obstinate cases the epidermis must be softened by applications of soft soap, which are allowed to remain for some time on the skin. This treatment is, however, severe, and not to be begun in the first instance. After the malady is cured the inguinal fold must be carefully kept dry, powder being freely used.

CHAPTER VI.

PARASITIC SYCOSIS.

WHEN *Trichophyton* attacks the hairs of the beard it produces a disease known as Parasitic Sycosis. This affection, although it occurs occasionally, is not common in England. It has been most frequently observed in Paris, where, however, it is getting more rare. The affection is supposed to be usually conveyed by the razor of the barber.

Lailler describes two degrees of it. In one, which he terms

¹ R Sulphuris Sublimati,
Olei Cadini, āā ℥iv,
Saponis Viridis,
Adipis, āā ℥i,
Cretæ Preparatæ, ℥ii ss.
M. Ft. ungt.

Pityriasis alba parasitica, the affection does not penetrate more deeply than the openings of the hair follicles, producing a very slight desquamation, and causing the formation of a sheath round the hairs, giving the well-known aspect of goose-skin.

The disease frequently spreads to the non-hairy parts, where it acquires the characters of ordinary *Tinea circinata*. In the second degree the parasite penetrates the hair-follicle, and each hair becomes the centre of a zone of inflammation. The cutis becomes congested, inflamed, and tuberculated; pus forms, the hairs loosen and are easily extracted. The inflammation may be so intense as to produce the aspect of a conglomeration of boils.

Diagnosis.

The quick rate of development, and the absence of cicatrices, distinguish it in the erythematous stage from *Lupus erythematosus*.

The bright colour, and the absence of itchiness and desquamation prevent the disease being confounded with *Syphilis*.

The limitation to the hairs distinguishes it from *Eczema*, which, even when it exudes and is purulent, is still not tubercular.

The diagnosis between parasitic and *Non-parasitic Sycosis* may present some difficulty. The parasitic sycosis develops much more quickly, non-parasitic sycosis being an essentially chronic disease. The parasitic disease is often associated with erythematous desquamating circles, and produces more exuberant mushroom-like tubercles than the non-parasitic affection. Examination of the hairs and the presence or absence of *Trichophyton* will remove all doubts.

Treatment.

Kaposi recommends painting the part with a 1 per cent. solution of perchloride of mercury, or the use of a soap composed of naphthol, sulphur, and alcohol, or the application of acetic acid, with the addition of dry sulphur immediately afterwards, stating that this treatment often renders epilation unnecessary.

Lailier, on the other hand, recommends epilation as soon as the inflammation has attained the stage of sycosis, parasiticide lotions in the early stages, and daily shaving of the affected part.

CHAPTER VII.

TINEA TRICHOPHYTINA UNGUIUM (ONYCHOMYCOSIS TONSURANS).

THE ringworm-fungus occasionally attacks the nails, sometimes being found at the same time on other parts of the body. It may occur in the nails of both fingers and toes, but it is usually only present in those of the fingers.

There is nothing distinctive in the degeneration of the nail-substance caused by the fungus, and it would be impossible without the microscope to distinguish the disease say from psoriasis of the nails. Eczema and Lichen ruber, when they affect the nails, produce similar appearances.

The nail is brittle, opaque, laminated, thickened, and soft, particularly at its free border, under which the mass, more or less thick, of softened broken-down nail-substance can be seen. Some of this substance examined in a solution of potash shows the presence of *Tricophyton*.

The affection is particularly obstinate, it being very difficult to get remedies to reach all the affected parts. The nail should be scraped very thin and, if necessary, *Liquor potassæ* applied with a brush to soften it. When that is done creasote or acetic acid may be dabbed over the part, or better still a solution of perchloride of mercury (two to five grains to an ounce) dissolved in alcohol and water, applied twice or thrice daily. Whatever treatment is adopted must be carried out carefully and persistently.

CHAPTER VIII.

KERION.

IN the fifth book of Celsus there is a description of a skin disease which he calls *Kerion*. One variety of the disease has the appearance of a large painful boil, and shows, when it is ripe, a great number of openings through which a gelatinous purulent fluid trickles, although this does not lead to the disappearance of the swelling. There is more decayed matter, he states, than in a boil, and the swelling occupies more space. It is nearly always found on hairy places.

Celsus distinguishes a second kind in which the affected area is somewhat smaller, but in which the surface is more "ulcerated." Otherwise there is no difference to be found in his description of the two forms.

The kerion of Celsus is thus a swelling which occurs on the hairy scalp, pale red in colour, honeycomb-looking in appearance, soft, and with many gaping openings corresponding to the hair-follicles, from which there flows a viscid bird-lime-like fluid. The swelling does not suppurate, but the hairs fall out with or without their sheaths. Sometimes, especially at the beginning, there is pain, and even fever. The cervical glands on the corresponding side are swollen.

In 1866, Tilbury Fox showed that the disease is caused by *Trichophyton tonsurans*. The disease is not common, but when once seen the appearance is so characteristic that it can always afterwards be easily recognised; indeed it is so unlike anything else that occurs on the scalp that it can hardly be difficult to recognise it from the description alone.

Dr. Tilbury Fox states that its characters are: (*a*) general prominence of the patch; (*b*) its perforation with foramina, *i.e.* the mouths of the hair-follicles; (*c*) the outpouring of a mucoid fluid; (*d*) the non-suppuration of the swelling; (*e*) the looseness of the hairs; (*f*) the after-baldness; (*g*) the presence of a fungus in the hair and follicles.

Although *Trichophyton* is found in some hairs, yet many hairs from a patch may be examined without finding any fungus. The disease is evidently due to unusual susceptibility on the part of the individual to the poisonous action of *Trichophyton*.

Treatment consists in extracting all the hairs and in applying a weak solution of corrosive sublimate or carbolic acid lotion.

CHAPTER IX.

TINEA IMBRICATA.

DR. MANSON has described a parasitic disease of the skin which he considers has been hitherto confounded with *Tinea circinata*. He describes it under the name of *Tinea imbricata*, and states that if it has been in existence any length of time it involves a very large surface, such as an entire limb or side of the trunk, or oftener still, if not checked, nearly the whole surface of the body. It is characterised by the abundant formation of scales, successive waves of which are imbricated over each other. It excites very little irritation, and contains the fungus in profusion.

Manson distinguishes it from *Tinea circinata* by the extent of surface involved, the absence of irritation, the imbrication and the profusion of fungus; the amount of fungus in *Tinea circinata* being usually not great. He also states that he has succeeded in inoculating *Tinea imbricata* and *Tinea circinata* on different parts of the same individual, and that in the result of the two inoculations the characteristic differences were maintained.

Dr. Manson was kind enough to send me a bottleful of scales from a case of *Tinea imbricata*. These scales are formed by small thin flakes, and certainly it would be difficult to have filled a bottle with similar flakes from such cases of *Tinea circinata* as we are accustomed to see in England. Manson observed the disease in Amoy, but states that all his patients, with one exception, had been at one time in the Straits of Malacca or the islands of the Malay



FIG. 21.—FUNGUS FOUND IN SCALES, FROM A CASE OF *TINEA IMBRICATA*, SENT TO THE AUTHOR BY DR. MANSON.

b, spores, and *d* mycelium, microscopically indistinguishable from the spores and mycelium of *Trichophyton tonsurans*; *c*, mycelium of fungi which from their comparative size cannot be *Trichophyton tonsurans*. *b*, *c*, and *d* are drawn by camera to the same scale.

Archipelago ; and he believes that *Tinea imbricata* is the same as the disease described as *pita* or *Tokelau itch*.

In examining the scales referred to under the microscope, I found that they contained various fungi. There was a considerable proportion of mycelia and conidia indistinguishable from the mycelia and conidia of *Trichophyton*. But there were also mycelia of a totally different aspect, some being smaller and some larger than *Trichophyton*. The engraving (Fig. 21) represents the appearances of the fungi seen amongst these scales.

THE END.

